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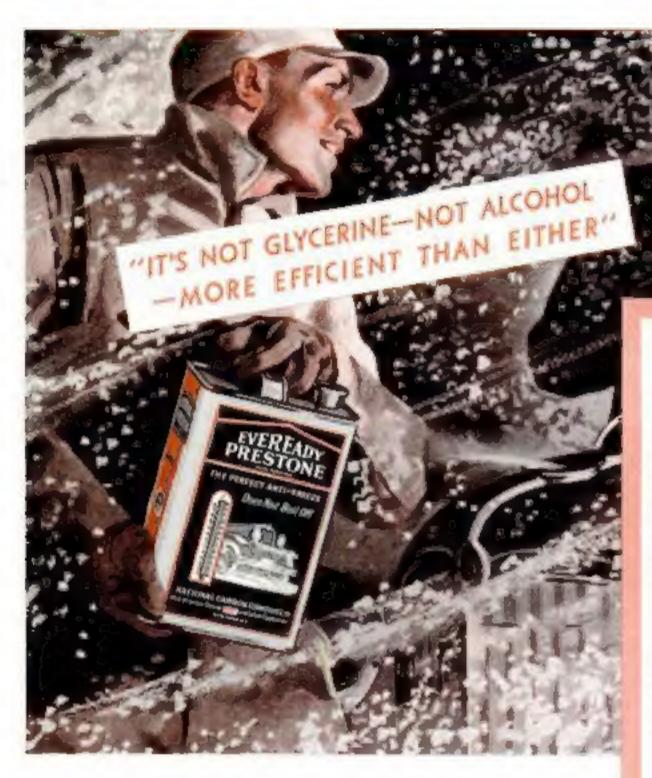
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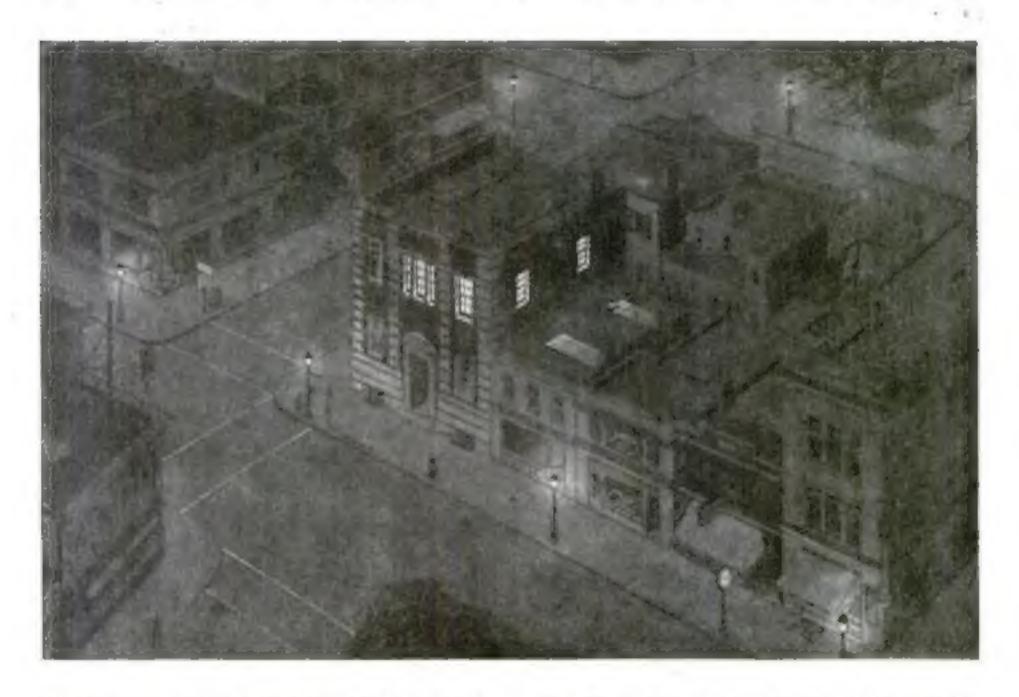


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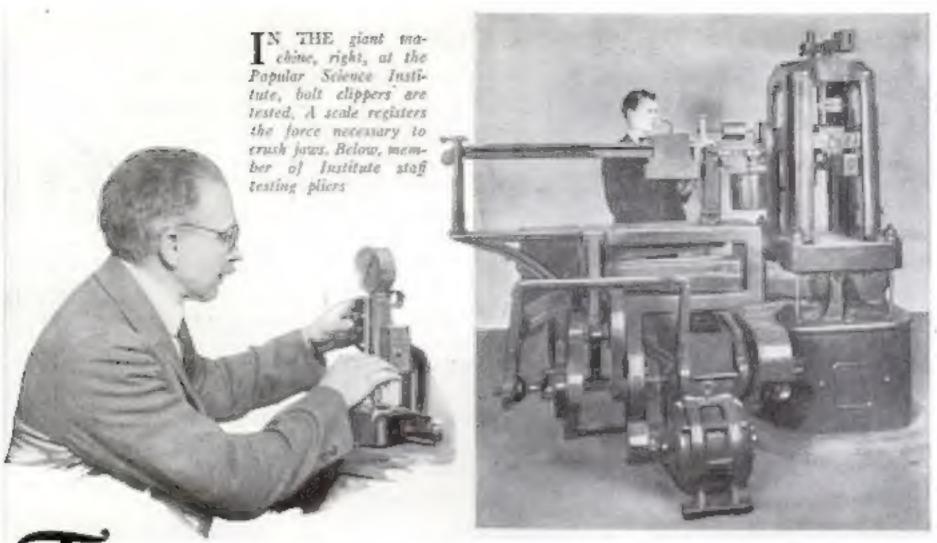
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In This Issue—Hundreds of Fascinating Articles Tell the Latest News of Laboratory Discoveries, Scientific Triumphs, and Amazing New Inventions



TESTS that Guide Wise Buyers

By R. M. Bolen

Secretary, Popular Science Institute

EARS are literally compressed into minutes at the modern tool testing laboratories of the Popular Science Institute. Here, almost human machines tell accurately, in a few minutes, facts that years of usage would only partially disclose.

Hammers are carefully tested, pliers are scientifically approved, and screw drivers are tried under the severest of conditions. So complete is the engineering equipment at these laboratories, that any buying advice given out by the Institute may be depended upon as being authoritative.

For nine years, Popular Science Institute has offered to our readers the advice of experts in several technical fields. It has made a careful investigation of virtually all the nationally sold products in the classifications of equipment in which POPULAR SCIENCE MONTHLY readers have shown the most interest.

Many products go through the hands of several testing engineers before they are approved. In the case of tools, the hardness of the metal will be investigated by one expert while others test other characteristics.

To do this special testing machines are required. For this reason, the Popular Science Institute tests are conducted in the well-equipped Sage Research Laboratory at New York University, where more than \$300,000 worth of testing equipment is available.

In the radio laboratory, receivers are subjected to telltale trials in which a loudspeaker is never used. Tiny indicators on electrical measuring instrumenta tell the story. By these, the engineer in charge can determine definitely and accurately whether the particular receiver he is testing will give a throaty gurgle or a faithful reproduction of the music and voices that are broadcast. Signals to test radio receivers have

their source in a miniature broadcasting station right in the laboratory, as outside signals might vary in strength and thus prevent conclusive results.

Each year many new radio sets are placed on the market and the wise buyer will take advantage of the reliable advice Popular Science Institute offers him. Recently, to make even more elaborate tests, part of the scientific radio equipment has



been inclosed in a small wire-shielded room. A double layer of wire screen serves to keep out all electrical interference.

The great value of the Popular Science Institute recommendations is shown by the fact that Professor Collins P. Bliss, Director of the Institute and Dean of the College of Engineer-

ing at New York University, has been called upon repeatedly by Government authorities at Washington to assist in projects where information accumulated by the Institute proved useful.

To obtain really helpful and accurate information regarding oil burners, the Institute conducted a nationwide survey of oil heating installations. Investigators were nent into 1,500 homes where oil burners were installed and 1,500 other owners of oil heating devices were questioned by mail. The combined tabulated results presented a clear picture of the antisfaction oil burners were giving.

Besides issuing carefully compiled lists of approved oil burners, radios, and tools, the Institute has also prepared books and bulletins which present accurate facts on heating and ventilating, insulation in building construction, oil heat, and air conditioning. The printed matter available from the Institute is listed on this page.

The Institute advisory service is available to all readers. Questions regarding oil burners, tools, radio sets, and approved lists should be addressed to the Popular Science Institute, 381 Fourth Avenue, New York, N. Y. Be sure to inclose a self-addressed and stamped envelope.

INSTITUTE BULLETINS

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Advice on Installing Oil Heat Air Conditioning Bulletin† List of Approved Oil Burners List of Approved Radios List of Approved Tools

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Painless ways of Saving Money

By LEON MEADOW, Financial Editor

THE story of Thomas Edison's exhaustive search for the correct material to use as a filament in his experiments on incandescent bulbs, makes a splendid "moral" for this article. Young chemists in his employ were told to try every substance upon which they could lay their bands, to pass up nothing before giving it a trial. Sometimes these young men would balk. "You can see this material couldn't do the trick," they would say. Edison's answer was invariably the same-"I don't care how you go about it, what you try or don't try, how foolish the experiments look or what your methods are. All I'm interested in is the result."

I don't know whether or not Thomas Edison applied the same reasoning to the business of saving money, but I do know that it is a rule which will certainly repay the man who follows it. Methods and places for savings are innumerable. Many people achere to a budget plan of one type or another. We all know people who follow no other plan but that of convenience, merely putting away varying sums of money when the spirit so moves them. As far as places are concerned, there are those who use the savings banks, others deposit their funds in building and loan associations. Some keep them in socks, shoes and cupboards. The one important thing is that they save money. How and where is, after all, of secondary importance,

Concerning the ever fascinating subject of saving money there is one thing that amazes me above all else. That is the ingenuity which men develop under the pressure of circumstances, and by circumstances I mean hard times. Let me illustrate this point. The other night, riding home on the train, I found myself next to a man whom I know quite well. As the holder of a responsible position in a large firm, and as the father of two children he has certainly had his share of worries in the last two years. We were talking about saving money.

"S AVING is a habit I formed early, long before I was married," my friend told me. "It is one that I cannot and do not wish to break, although I certainly have reason enough to do so these days." And he did, I reflected, for I knew that in the last two years he had taken three successive cuts in salary, totalling in all a reduction of almost thirty-three and one-third percent.

"My wife and I," he continued, "have lived according to a budget plan which we mapped out a good many years ago, and a plan which has enabled us to save a nice sum of money over that period of time. I'll admit it got harder as the children grew up and our interests started to broaden out. Then came my first cut in salary. It amounted to 15%, and this, together with increasing family expenses, virtually wiped out our weekly surplus. Since that cut I have not been able to put a cent away in the bank, as scheduled in the savings account department of our budget plan. Yet, in the last two years I have saved \$400."

"Hold on," I said, "you just told me you couldn't put a cent away, and now you say you saved \$400. What are you trying to do, kid me?"

"No, I meant I couldn't save according to budget plans, but I found another way. I never spend a penny or a dime."

"What do you mean?" I asked, visualising some new kind of miser.

"I mean," he replied, "that if I want to buy a pack of cigarettes for fifteen cents, and I find myself with forty cents in change—consisting of a nickel, dime and quarter, I break the quarter. If I get my change in a ten cent piece, I then have two of them. When I get home at night, first thing I do is throw those two dimes in a little bank. I do the same thing with pennies."

I was surprised, to say the least. This amounted to making a game out of saving money. But, as I said before, it's the result, and not the method, that counts. "Do you mean to tell me." I asked, "that you saved \$400 in two years by doing that?"

"HAT'S right," he said, "It averaged \$200 a year, and I'm perfectly sure that it will again average as much this year. Don't get the idea, however, that I'm a fanatic about this thing, Carrying it to an extreme would rob me of the pleasure I get from doing it, and, you know, it is a lot of fun. If I'm waiting in line to get into a bus or subway and I have a dime, and a ten dollar bill in my pocket, I won't hold up everyone by demanding change. But under ordinary circumstances I refrain from spending a penny or a ten-cent piece. You can call it a painless of a funny way to save money, but nevertheless (Continued on page 7)

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PAINLESS WAYS OF SAVING MONEY

(Continued from page 6)

it's helped me beat bad times. I knew it would be virtually impossible to deposit five or ten dollars a week in the savings bank. Yet, here I am, saving \$200 a year.

and actually not feeling it!"

"I don't think it's funny," I replied. "On the contrary, I think you've done a rather remarkable thing. What's the difference how you save, so long as you save? But, tell me, what do you do with this

"I put it in the savings bank every six months. Just before Christmas I withdraw some of it and give it to the children to use for buying their Christmas presents.

The rest of it stays there."

The train pulled in at my friend's station, and he got off. I was left alone to my thoughts and newspaper. But the latter went unread because I simply could not help thinking about this funny way of saving money, And yet it was no funnier than it was effective. Certainly no one could sheer at a saving of \$200 a year in these times,

By the time I got to the office the next morning I had decided to do a little further investigating on this subject of money saving methods. I called up various savings banks, but no information was available. Yet, in the course of the day, I managed to unparth a few more examples. For instance, I ran across a man who used the same method, but on a more elaborate scale. He never spends a fifty-cent piece! He told me an interesting story in connection with his scheme, which he has practised for the last year and a half only,

"THIS past summer," he said, "my wife and I were anxious to send our buy to camp, or rather to send him back to the same camp, as he hasn't missed a summer in the last five years. He had had a slight attack of pneumonia in the winter, and he needed building up badly. However, bad times have made no exception of our financial standing, and it seemed to be an absolute impossibility to spare the money. In looking around for the money I thought of my special savings account and thought maybe I had enough there for the camp tuition. Every few months I take all my fifty-cent pieces down to the savings bank and deposit them in a special account, I never paid much attention to the bank book, because I've always looked upon this crasy method as a hobby rather than as a means to an end. The bank keeps the book on this special account, so I asked my wife to go down and see how we stood.

"As soon as I got home that night, my wife loosed a verbal attack on me, 'Say,' she said, 'what have you been doingbolding out on me?"

"'What do you mean, what are you

talking about,' I asked.

"'You know what I mean. That special savings account of yours bad \$677 in it. That means camp for Johnnie this year.'

"I was just as astonished when she told me that, as she must have been when she found out how (Continued on page 8)

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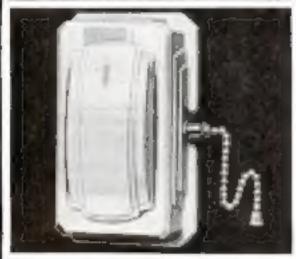
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PAINLESS WAYS OF SAVING MONEY

(Continued from page 7)

much we had down at the bank. Not astonished at the amount, but surprised that any such peculiar hobby should result in so practical and beneficial a savings method. Call it crazy if you want, but you can't argue with figures, and \$677 speaks for itself."

The word "crazy" was furthest from my mind. After the "penny and dime" story I was ready to believe almost anything. In fact, the only thing left for me was to wonder at man's ingenuity. But I still had one more surprise in store for me.

That same afternoon a man came in to see me about a financial matter, and in the course of the conversation, I had occasion to mention these unusual money saving methods. He didn't seem as surprised as I thought be should have been. This is why:

He knows a man who, when he was a baby, received from some relative a silver dollar coined the same year be was born. That man kept the dollar and, incidentally, still has it. Almost ten years ago he decided that it would be a rather amusing hobby to collect and keep all the coins he came across that were minted the year of his birth, which was 1884. Sounds like just an amusing pastime, or a sentimental whim, doesn't it? Well, he has quite an extensive collection now-and it happens to be worth nearly \$4,000. And I don't mean collector's value, either. I mean \$4,-000 in current actual value, as represented by the denominations of the coins. Unfortunately for him, he incurred an unforeseen obligation last spring. The only possible way of meeting it was by dipping into his collection. Fortunately, he had that collection, and it had in real cash, face value.

I THINK I might search for a long, long time, and never find an odder way of saving money. But no matter how queer a story turned up, I believe I would always feel the same about it. Any honest method, whether it appears funny or works like a game, that accomplishes the purpose of saving money is a good method.

The one thing that appeals to me about these amusing experiments is that they encourage the saving of money, without laying down any hard and fast rules such as a budget demands. Once the budget rule is broken, people find it difficult to get back into stride again. On the other hand, those who use the above methods break their rules every day, since it isn't possible—unless one is fazzatical about the thing—to do otherwise. But here the breaking of a rule isn't so serious a matter; there's nothing to be made up, and consequently it's easier to start saving again.

Don't believe for a minute that this argument suggests a substitution of these unique savings methods for those employed in all budget plans. The latter deserves and has earned its proper place in everyone's financial picture. My point in writing this article is merely to show how people, reacting under economic pressure, become ingenious (Continued on page 9)



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PAINLESS WAYS OF SAVING MONEY

(Continued from page 8)

about savings problems; how they get around all the mental hazards of had times and still manage to save money in ways that don't make them feel as if they have to go without one meal, a day to do it. The budget itself has a different and larger place in the financial scheme of things. In fact, it is large enough in scope to adequately and comfortably embrace any of the above savings methods. These painless ways of saving money can be worked into a budget system easily, and with happy results.

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WANTED

men who would like to retire at 55, 60 or 65

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Buunen address.		
I was been	Total Control of the	Y

Our Readers Now, You Old Dog Hater. Will You Behave Yourself? As a dog-lover I rise in defence of my

camne friends R G New York, evidently is one of those individuals who would era ifcate those who saffer with tuberculosus in order to stamp out the disease. As for the hydrophobia scare, had human teeth cause much more trouble. R. G. has a fist sized piece of ice where his heart should be. Dogs and men have been comrades for hundreds of thousands of years. In return for decent treatment, these "noisy, dirty, flex-bitten beasts," will give their lives for the master whom they serve

The faithfulness and devotion they lavish lipon mankind la out of all proportion to what they receive in return. Doga have been known to starve Themselves for grief at their muster's drath, and to travel thousands of miles



to find a master who had deserted them. A man must be deaf and bland who has not seen or heard some lestimony of the devotion of the dog to mankaho, Must we destroy them all, because some of them become ill? Perhaps at some future date, when mate and friends are gone, R. G. might be glad to have the affection of some dog, bestder the consolution afforded by his pipe and his book The worst punishment one could wish for h m is that he sha I never know such affection. J C Q., South Manchester, Conn.

This Back Seat Driver Wants & Crucible Furnece

It I may be permitted to change the name of your department, "Our Renders Say," to "Back Seat Drivers' Forum," I will climb into the rear seat and begin prodding the harried driver by expressing my approval of your article "Casting Small Metal Paria" in a recent haus. May we hope for an article in this series devoted to a small crucible furnace? A crucible, a few fire bricks, a little fire clay and an old vacuum cleaner motor will turn out quite a crop of foundrymen.-FPH, Pocatello, Idaho

Before You Get This Solved. the Bubble May Burst

I AGREE with G.N.P., of Connecticut, that there should be more and better problems to mathematics in our magazine. Just in case

GNP, hasn't, as yet, been mitsfied with those that have been published, I suggest that he start work on this one, which may serve to while away the winter eveningsmany of them A spherical soap bubble is being inflated at the rate of two-



tenth cubic inches per second. Find the rate at which the radius is increasing when it is one and one-half inches long .-- A.P.B., East Lynn, Mass.

The Winding Old Passaic Runs Its Cods Around New Jersey

WHILE on the subject of crooked rivers. kindly permit me to enter the Passaic River of New Jersey as one of the most promising candidates for high bonors. It is 128 miles long; but the distance between its source and its mouth is only seventeen miles. Moreover, through its whole course, it indulers in twists and contortions that would arouse the despairing envy of the most agile serpent One of its coth makes a complete horseshoe around the City of Paterson, and there are other twists of almost as extreme a nature Beat this, if you can !- J.F.M., Paterson, N. J.

Sarlors Can't Swim But How About Your Cats?

I tetat with much interest the article by Randy Enslow, "Out of the Air on a Bag of 5ilk," but there was something he said that I considered "out of whack." To quote his own words, "Knowing how to handle a parachute and make a jump is as important as knowing how to swim is to a soilor Believe it or not, this strange fact is true Ninety percent of sailors can't swim. So if the author wants to impress on the minds of the many sador readers the importance of the parachute, he should have said, "knowing how to handle a parachute and make a jump

is as important as know ng how to ride a borne in to a cowbus " Some of you land obbers and air sailors may my this nanety percent stuff is all boosy but I can state this strange fact with quite a bat of authority as I am A sa for and my dad havbeen one for over



thirty years, and although we are both good swimmers, we have found that the majority of sailors can't swim. Most sulors hate the water, or at least the actual submersion in it, worse than a cat. Now, you land abbers, maybe here is something you can catch me up on. Maybe cats lon t hate the water but hear they do Bt G. Vancouver, B C

Your Ladders Show Street Is 26 Feet in Width

Tux leaning, intersecting indder problem submitted by G.N.P., of Meriden, Conn., in which it is required to find the width of the street presented tow real difficulties. I find the answer to be 26 plus feet which is the distance from burie ng to building. Tave us more.- J.J.S., Sen Sule Park, N. J.

Constant Reader Wants Moce Motorbike Stuff

I have been a constant reader of Popular SCIENCE MONTHLY for the last Mx years, and would gladly give my last fifteen cents for a copy. I enjoy the aviation and automobile

features very much. I am interested in motorcycling, and wish you would give us some more articles on that subject like those you ran in a previous issue. I should like to see somebody make a cross country cide on a motorcycle, or something on that order to promote interest in this aport.-F J L., Houston, Texas

Maybe the Adult Workers Stuck to the Alcohol

Our cold night last autume, a paper wasp nest was carried into a laboratory at Johns

Hopkins University and pickled in micabo. Later, the interior of the nest was excefully studied Examination showed there were only 407 wasps, mostly drones and queens, living in the 3.195-cel. nest. The adult workers numbered seventeen. This verifies the opinion of previous in-



vestigators that in the fail most of the worker waspe die. What I want to know is. It the sicohol had the same effect on the wasps ft has on pickled human beings, shouldn't the seventren adult workers have been able to keep the entire Johns Hopkins' faculty on the jump for at least a year? And was the alcohol good for anything when the waspa got through with it? If not, why waste it on the waspa?-F.A., Baltimore, Md

Please Consider Yourselves Duly and Truly Warned

As I am a regular reader of your magazine, I am going to ask you to insert a small article warning your readers against all green light duckts I or a ng through such a shield, you find red lights cannot be seen, with the resufting danger of running past traffic signals. -O W G., Rock Island, Ill

This City Boy Determined To Be a Real Farmer

I am an American who intends to return to the States soon and go into the farming game. I am suce the numerous readers of your magazine would be greatly interested in a page or two each issue of practical suggestions on planting crops and rewing animata. I have been in Chile for the last

DYG YEARS ADO 1D: longer I May away from home the more I appreciate the good old USA. I am interested in farming as I have been involved in humerous enter prises connected with agriculture. The most extraordinary part of all is that I was born



and lived in New York City for eighteen years I am sure there are thousands of other young fellows who would be glad to go into the oldest and most stable profession in the world, to be a farmer! However, the comparison of farming thirty years ago with that of today is of no practical value, although it makes nice reading.—B M., Santiago, Chile,

That Jumping Frog Has Nothing on Leaping Loop

Here is a question for some unoccupied scientist to answer: Take enough pieces of eight-inch from wire to make a three-tach core for an electro-magnet. Around this core you wind 100 feet of No. 8 doorbell wire, thus making an electro-magnet for 110 volts.

Next, you wand sevent -five feet of No. 5 we into a crose, fastening the ends together. The inside measurement of this loop is three and three-quarters inches, Place this loop around the end of the magnet. When you turn on the current, the loop of



were well jump from two to three feet into the air. Why does it do this?—K.T.G., Lansing, Mich

A Few Brief Words About The Ellipsoidal Hypothesis

THE statement by Sir Arthur Eddington that distant spiral nebulæ are receding from as at rates up to 25,000 maies per second, and that the universe is expanding proportionately, vertices the Ellipsoidal Molecular Hypothesia of matter. If we assume as in the Ellipsoidal Hypothesis that the rythmic impact of a large number of ultimate particles upon the et quotes, surface of the molecule maintains both the characteristic shape and density of aggregation to form that substance, then we have to account for the force that must react against other ultimate particles throughout space until balance has been arrived at kinetically But wherever a continuous force is brought to bear between masses to produce a Velocity apart, a uniform acceleration will be increasing this velocity. So that the apparent velocity of recession of the nebular will increase with time, and this acceleration times the masses involved will represent the total reaction balancing the forces astrally avuilable on the earth. In any case, the observed expansion of the universe must revert to the ell-psordal formation in matter to formulate a reason for such expansion, more particularly when it can be shown that this expansive velocity increases according to the laws of acceleration with which everyone is fam inc. -- E.N.B., Dopora, Pa.

Maybe the Spider Got a Fly to Carry One End Across

I are writing you about a little problem in construction and I hope you will publish this, or an answer to the same, in your magnetic as moon as possible. Coming out of the house today, I looked up and naw a single

speec well hanging alout ten feet from the ground and connected to two trees that stood about forty feet apart. The ends were attached to the frees at approximately ten feet from the ground. The thing I want to know is how the spider got the web across this great dis-



tance at such a height from the ground.— M.O.M., Nashville, Tenn.

It Tuens Out Your Field Has 12.710 Square Feet

I have been a reader of Poeutar Science. Moximize for a long while, and wish you to keep the magazine as is. In looking over a late issue, I discovered a problem about the area of a certain rectilinear field, by our good reader CAP, of Monrovia, Calif. You head the article, "Oh, Feet and Feet and Feet at least—and Maybe more." In solving this exercise, I found the length to be 1274 fret, and the diagonal to be 1613 feet, any me a total area of 12,710 square feet.—C.F.M., Drumright, Okia.

Chief Himself Hands Out Some Delightful Praise

Your article, "Spot Crooks by Their Ears" is a real contribution to the science of identification.—Charles R. Sheraton, President National Identification Assn., Brooklyn, N. Y.

Surgery Now Cutting Real Scientific Swath

Have just finished reading your "Triumph of Surgery," and I'm all excited and enthusiastic about it. It just happens that a whole and I did some reading on the early history of surgery—about the work of Ambrouse Parë and the great Hunter and, of course, Lister As a result, I wasn't so bot for surgery Naturally, I knew harbers were no longer surgeons, though a lot of people still call them butchers, and their shops are marked by the red and white surgery poles of a dead age. That is to say, I realized, vaguely, that progress has been made, but Dr. Damrau

amazed me with facts showing the coloseal strides that actually have been taken by surgery. It's great stuff, and I'll certainly eat up every article Dr. Damrau writes for you—and tell ull my friends. In my opinion, every one in the United States should read this series and



get wise to the everyday mirarles that are being worked by the modern surgeon,— H L.S., Albany, N. Y

Just Goes to Show, You Can't Please Everybody

I make been reading Portian Science Monthly for over two years, and I find it most interesting. But lately trime and cobberies have taken the place of interesting articles. Let those who stood for probabition find out all about trime, the negatiited trime that it created for the benefit of the American people. Couldn't you change those articles on robbecies for more interesting ones? Something about electricity, talkies, archeology, wiseless telegraphy. By the way, why don't you create a question box, for those who subscribe to Poppelar Science Montally so they may ask questions and get the answers published? NE, Los Angeles, Calif

Our Plans Enabled Him To Build Trim Little Boat

We take reading an usue of Purvetae Science Monthly some time ago, I amy the plans for a combination sail and outboard motor-boat that appealed to me for both beauty and apparent seaworthness. I ordered the plans and started constructing the boat as soon as they arrived. This was toy first attempt at boat building and it was only because your plans are proper plans that my effort-were an successful. I have received many

compliments on my boat building ability and I want you to know that your magazine and plans came in for their share also. The list of materials was correct and the actual cost was within a few dollars of that which was estimated.—W.E.H., Pacific Grove, Calif.

Let Potato Bugs Sound Their Own Death Signal

Here's one your farm-belt readers should be interested in: A "potato-bug alarm," has been invented by a student of the College of Agriculture, Cornell University, Ithaca, \ \ The best time to kill potato bugs is at right

when the plants are covered with dew However, the dew does not form every night and kerping awake to watch for it is barden as tarmers. So the Cornell student has devised a contraption in which the formation of dew closes an electric switch and rings an alarm at the



bead of the farmer's bed. The only thing better than that would be to have the hugs themselves ring the alarm. At any rate, that would save electricity and the bugs would be no worse of .—H.A.B., Advian, M. nn.

Still More Short Wave Radio Stuff Is Wanted

I make read Our Readers Say for several years and am a subscriber of Port can Science Monthly. This magnetic sure takes the cake. Here's boping that we see more radio dope. Especially beginners' diagrams of short wave acts featuring bome made parts, and better still short-cuts in making these parts, keep on with Popular Science Monthly, I am for you.—M W W., Industry, III

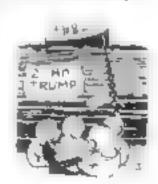
It's Hard to Answer a Complaint Like This

I am very, very dissatisfied. I have been reading my latest Porvian Science Mostritty and now I have finished it and like Oliver Twest I ask for more—and there inn't any more. Though nothing is perfect, Popular Science is nearly so from my point of view. If I had my way, I'd make it about ninety-nine per cent chemistry, with perhaps, a little electricity. I should like to tell P.N.C., Norfolk, Va., that motorcycling has nothing much to do with science. I must thank Raymond B, Water for his chemistry department.—W.L., Preston, Victoria, Australia

What a Time at Sea for the Poor Sub. Sadoral

I just read that the 5,000-ton North German Lloyd liner, Westfalco, will be "anchored" in the Atlantic, 500 must from land to form a floating air station for planes flying between Africa and South America. The 400-foot ocean casis will be stationed per-

manently midway between Bathurst, Brush Gambia. on the African coast and the island of Fernando Noronha off Brazil. The stinet But just how do you "anchor" a ship in mid-ocean? To what and with what? Probably they send a submar-



the down and have her crew hang on to the ship's cable to keep her put. I'm just a land-lubber and wouldn't know, but it sounds like horse feathers to me.—R.O.C., Westerly, R. L.



Auto Lights Save Planes Lost in Fog

Prawing by B. G. SEIELSTAD

Summoned by radio, 2,500 motorists lined an unused California field the other day to rescue two jog-bound Navy planes. While the ears' headlights formed an improvised beacon, as shown above, a big transport craft jound the flyers and led them to a safe landing. They had gasoline left for only twenty minutes' flying and faced the prospect of diving through the jog to an almost certain crack-up



POPULAR SCIENCE

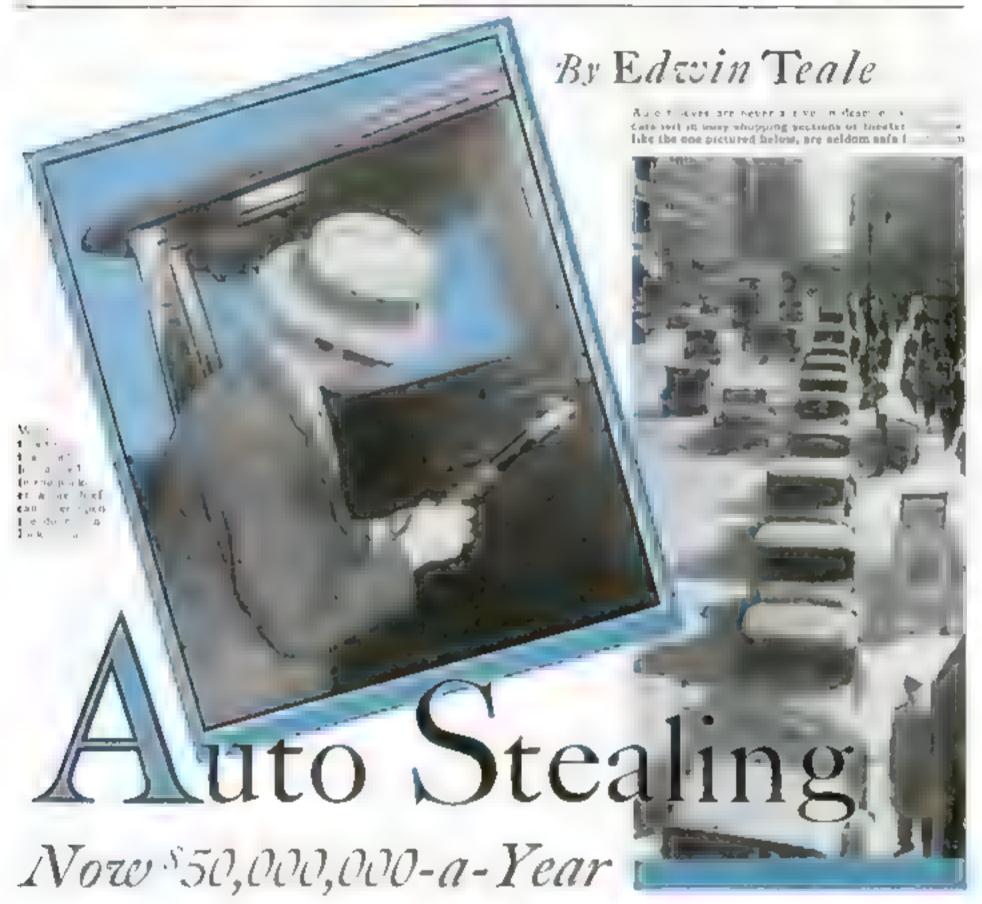
MONTHLY

January 1933

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RAYMOND J. BROWN, Editor





BLLE roadster, traveling at high speed, rounded a curve outside a New Jersey town and apporently vanished into thin sir

Five minutes later, two motorcycle cops, flatened against whizing machines, raced around the corner, flashed past a lumbering furniture van and headed after the stolen car.

Without knowing it they had already passed it Smigly boused within the big van, the roadster was already the center of attention of a corps of experts. License plates were being shifted, wire where were being short futed for wooden ones, gray quick-drying paint was being applied to hood and body.

A hundred me es away across the state one the van stopped. A light steel runway slid to the ground from the rear of the truck and a gray roads, er, with wire wheels and Pennsylvania

RACKET

license plates, rolled to the pavement ready for sale to an unsuspecting buyer. The latest track of a motor-stealing mob had worked and the police were haffled

The detective who told me of this ruse, estimated that the automobile stealing racket in the United States has mounted to a \$50,000,000-a-year business. During the first six months of 1932, 36,000 machines disappeared in seventy-two American cities alone. In New York City, \$2,000,000 worth of cars were reported stolen in 1931.

Syndicates that maintain special machine shops for altering



A rush job of painting on the stolen car us ng quick-drying paint changes its appearance so police are unlikely to spot it on the stress

ward J. D.I on for eleven year the Automobile broad of the New York Lity police, told me, there is a master mind who does the planning and directing Under him, apecialists form the cogs of a smooth-running machine, The "spotter" or "finder" spends his one pick og out cars to be stolen, studying the habits of their owners and choosing the best time for the theft. The "get way man does the actual stealing. Another alters the motor numbers and changes the appearance of the cars before they are offered for sale. This underworld mechanic is known as a "grease ball." In addition there is a "paper man" an expert forger who prepares the take bills of sale and the false registration certificates by means of which the purchaser is thrown off his guard when a sale is made

Such gangs are rated by detectives as among the most slippery of the underworld. Almost every week some new trick or ruse of these men who deal in storen cars catches the motorist unawares. One of the slickest of their recent innovations is known as "maceing cars." Here is how it Works

Two prosperous-looking strangers come to town and rent a large showroom on a

MAKES HIBBIEST I KR ES PAID " B. fore long, the machines start comme in Each owner is dealt with

in approximately the same way the dialogar number wong about like this

How much do you want for your car as it now stands.

"It ought to be worth \$250 "

"Oh, we can sell it for more than that I m sure we can get \$300. But, when someone comes in with cash, we have to sell on the spot. Any delay may lose the sale So you'll have to leave your keys and papers here. However, to protect you and show our good faith, we will give you a note for the whole \$300 which will be payable at the bank in thirty days

Delighted at the prospect of getting more than he expected, the owner goes off with the note. Three weeks pass. The showtoom is crowded with cars. The part ners seem to be doing a thriving business Then, one morning, the owner passes the place and can hardly believe his eyes The showenom is clean as a whistle Every car has disappeared over night!

Members of the gang have drifted into town and stealthily driven the machines away write the clusters stept beading in all directions to make tracing difficult The partners are gone, And at the bank the owners get another jult. The notes are worthless scraps of paper

The best part of the racket from the crocks' vewpoint is this Even if they are rough they face only a civil anal no. a criminal one. According to law, they have not stolen the cars; they have bought

them with worthiess notes

Recently, Harold G Hoffman Commissioner of Motor Vehicles of the State of New Jersey, reported another ingenious ruse being used by auto thieves. A stolen car is left at one of the small garages controlled by the gang. Some time later, the owner of the garage appears with a large bill for storage and fictitious repairs to obtain permission from the Motor Vebacle Department to sell the machine under the Garage Liea Act. Such permission when granted, gives him a clear title to the car making it easy to aispose of To outwit this strategy the Department is mak-

Using New Tricks and Mechanical Devices,



Locking a parked car with the windows al ghily open from the top in dangerous as a thirl. with a hook the this, can reach in and turn the handle

ng special investigations in connection with all applications of the sort

Last year the Director of the Chicago Crime Commission, Henry B. Chamber-in, told me of a gang that specialised in sieu ing cars to order. Chauffeurs acted as agenta. When they heard of someone in he market for a certain type of secondhand machine, they would appeared him with the story that "a friend" had just such a car which he would sell cheap. Then the map would pick out the required kind of automobile on the street, steal at, and turn it over to the buyer in a transaction go fast to give him time to think

Not infrequently, I am told, a gang will place one of its ace "spotters" as a workman in a large garage. In New York City not long ago, the loss of nearly two dozen cars was traced to the activity of one such inside worker. He would pick out a car and then, during hinch bour, take the key to a nearby locksmith to have a duplicate made. This duplicate, together

rilhop in a midrown New 3 horel. He would steal away from his post, drive a car which had been b darade alo 1 & 4 at the hote. working working

Invariably some such alibe is carefully worked out beforehand.

Probably the eleverest instance of the kind was related to me by a detective friend of mine in Florida. The owner of a car had just entered a store

when he beard the motor of his machine start and looked out in time to see it drive away from the curb. He gave chase and the thief was caught two blocks away

Here was his story

His brother owned a car that looked mentically like the one he had taken. He had duplicate keys and permission to drive it at any time. That morning, his brother had told him be would leave the car parked near the store for him to pack up. When he saw the machine there, he was so sure it was his brother's car that be had stepped in without looking at the license plates. Officers brought his brother to beadquarters. He verified the story of the suspect just as he had told it

Continuing their investigations, the police made a remarkable discovery. The two men, they found, were members of a gang that specialized in stealing one make of automobile and the car "owned by the

is h i be atolen? The answer is a nediata-priced, well-advertised, pop mand and consequently easy to dispose frequently stolen var a from year o year, according to shifts in fer-Flores keep their fingers on the of parametry and choose machines --

Machines with terroraal lie or s riking you bred pant its a T C T C T C T C T A ral cost that was too high or to the state most likely to be insurant from High-priced cars are too hard to sell and cheap cars don't bring enough to be worth taking. Consequently, the thief concertrates on the popular, middle-priced, widely-used makes, favoring new models with the latest equipment

The zero hour for stolen cars is between eight and ten P.M. More machines disappear then than at any other time during a day. The most dangerous spot in a city to leave your car is the theater district. The center of the shopping section is another risky place. Care are coming and going all the time and the theef attracts no attention as he drives

away from the parking place.

Currously enough, the bigger the crowd, the greater the danger of your car being stolen! Spots near a stadium where boseball games, petrefights, or wrestling matches are held, are familiar bunting grounds for the auto thicf. The assurance that the owner will be gone for a definite length of time gives him the opportunity to use his taped pipes for snapping door locks, his ingenious "jump wire" devices for getting around locked switches, and his big assortment of (Continued on page 96)

Gangs Get Over 36,000 Cars in Six Months



Buttonhole Microphone Catches Platform — Gigantic Reflector

> THEN football crowds roar, radio isteners now hear them in their loudspeakers, not us a mufiled, distant mormor but as clearly and far hfully as though sitting in the grandstand. When a broadcast is made of a political meet-

ing or any other public assembiage, every speaker on the floor of the ball is heard by the radio public as distinctly as are the platform orators. No need for long-winded announcers to cut in; the man sitting at home beside his radio set often can bear more than the occupants of the expensive angaide seats

Startling recent improvements in rophones, the electric ears that represent wherever anything of importance is hap- ing, have made this possible. Latest styles mikes, ranging from a tlay black button n inch and a half in diameter to a huge bowl

feet wide, have forced old-time technimans to revise their ideas of what can be put he limitations of the microphones with which they were obliged to work.

The midget of them all-a curious little rument known as the lapel, or buttonhole, rophone has made over broadcasting - hods. Some months ago, New York engior m of a great electric company were called mon to solve a problem for public speakers. Lecturers distiked standing in front of a fixed nicrophone, They wanted to be free to move about the platform without interrupting their becourse. The engineers' answer was a "butbole" microphone to be worn in the speakatton picked up his voice and a small trailing were carried it across the floor to the ampliers and loudspeakers. Broadcasting directors were quick to grasp the possibilities of the midget make

A rush order brought a supply of them to Chicago on the eve of the Democratic Naronal Convention last summer. Microphone uns from the rear of the hall were carried meng the roof and dropped at six points in we convention hall. At each of these stations, s page boy held a lapel nucrophone connected to a circuit, and a chart showing the location . 1 each of the state delegations. When the · e of a certain state was called for, the rest page buy hurned to the leader of the egation and clipped the microphone on his mel. He then announced the vote of his state an ordinary voice, which was heard from st to coast. Often the radio audience heard vote before the chairman of the convention, who was sitting right in the hall, - त्तु हो

Since that successful experiment, uses for tapel macrophone have multiplied. An announcer appeared at a recent football game with a pair of hinoculars wired for sound, A lapel microphone mounted beneath the lenses enabled him to describe the play without Multiply Radio's Voice

taking his eyes from the players on the field Actors and actresses donned lapel microphones not long ago to add realism to a radio drama. Reading their lines from prepared acripts, they were able to move freely about the studio. It is apparent, the little black

In one recent experiment, a noted woman swimmer broadcast her sensations from an aquaptane behind a speeding motorbost spenking into a lapel microphone that was fastened to the shoulder-strap of her bothing suit, ready to catch everything she said

button has almost infinite possibilities for it

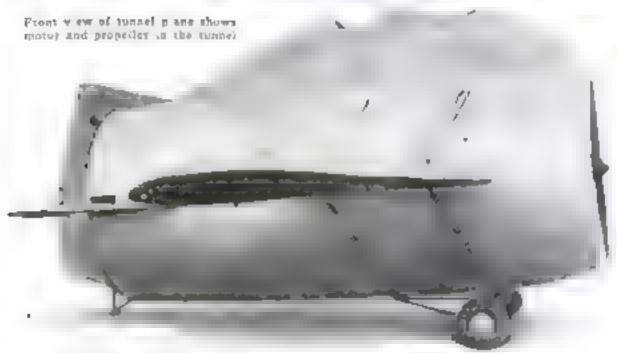
can go wherever its wearer takes it

Today, however, a microphone can remain in one place and still pack up the voices of distant speakers, Recently perfected for broat ist use is a "parabolic reflector microphone. In it the microphone proper is built into a huge bowl-shaped reflector that focuses the sound upon it. Lake a searchlight, the reflector may be awang in any direction and named at the center of interest. Crowd noises and band music at football games are now picked up by the parabolic microphone-s more sa afactory and flex ble method than the former one of stringing half a dozen or more standard microphones around the field and cutting them in or out as desired. Operas have also been broadcast with the aid of the parabolic mike, which gives a better blending of instruments since it may be placed at a distance from the musicians, Two of the large est parabolic microphones ever built, each five feet in diameter, were used at the Demperalic convention by one broadcasting chain A special concrete mold, weighing half a tonand shaped like a hird both, served as a form for their construction.

NEW fidelity in sound reproduction is claimed for the "moving coul microphone" and the "velocity microphone"-both fresh from the laboratory. They operate like dyhamit loudspeakers in severse; the moving element, veheated by sound waves in a magnetic field, generates electric current that reproduces the sound. The velocity microphone is remarkable in that it has no diaphragm, thus disposing of a source of possible distortion in the "carbon-grain" and "condenser" types in general use. Meanwhile these standard types are undergoing marked improvement that adapt them for new and amazing purposes. For instance, they make audible the heart best of a patient during a major operation. They report dangerous strains in the masonry of big dams. They tell of the activity of machinery in great factories. In case of war, they would warn of the approach of an enemy ship while it was still forty miles at sea. So sensitive are they, that experts listening to them, could tell whether the vessel, still far beyond the horizon was cruiser, bactleship, or harmless merchan man and in accordance with this information take the proper steps for defense,







S do wlow showing the priot's tiny cockput antr do the plane's formal funcings

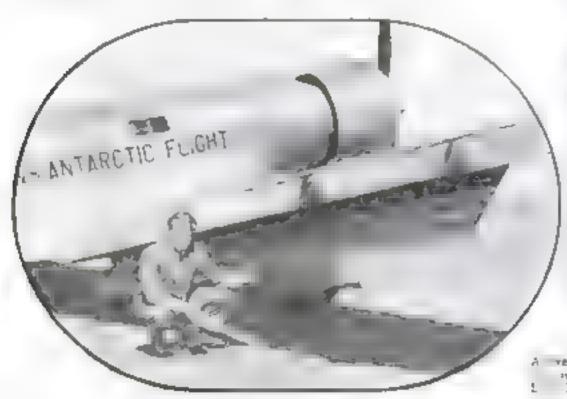
NEW ITALIAN PLANE HAS TUNNEL-LIKE FUSELAGE

Fit a hollow, wooden cylinder with wings and a propeller and you will have something resembling a flying tunnel that has just been built and successfully flown by an engineer of the Caproni airplane works in Italy. The pilot si a in a tiny cockpit astride this strange mathine, while motor and propeller are mounted within the tunnel-shaped fuselage. According to the inventor, the plane's radical design utiluses the propeller's thrust to maximum advantage. Since the slipstream of the propeller does not impinge upon wings or fusciage, there is little retarding drag, but the tail control surfaces are exceptionally responsive. With the success of his first two-seater, 120-horsepower sport model, the inventor sees future application of the design to much larger aircraft with far greater carrying capacity

Air Brakes for Planes Greatly Reduce the Landing Speed

At a brakes for planes have appeared on some of the newest machines, following the success of the innovation in tests. Hi herto pilots have resorted to the risky practice of side-supping to avoid overshooting a landing space of limited area. The new air brakes, consisting of expanding fins designed to create an air drag, slow down a plane and enable it to settle safely to earth at far less than its usual landing speed. One type, designed by a Calitornia inventor, is mounted on the wing strute. Its two halves when closed form a streamlined profile like

a wing, and unfold to present a broad impeding surface. Another style, hinged to the trailing edge of the wings, has been installed on the bug metal monoplane that will carry funcoin Elisworth noted Arctic explorer, and Bernt Balchen on a projected 3,500-mile flight across the Antarctic over unmapped territory. It will insure tafe landing on runways in the polar ice.



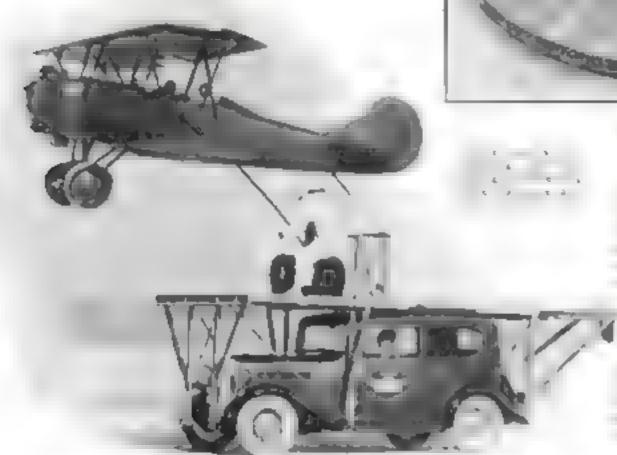
TWO TYPES OF PLANE BRAKES

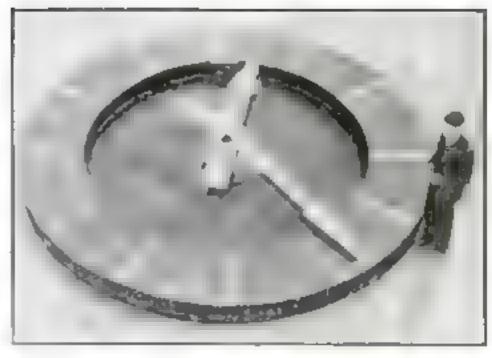
A we, air brake for a plane, designed by a California inventorsented on wing strute and unfolds to check plant a speed.

Bernt Balchen points to air brake on his Antarctic plane.

BIG CLOCK GUIDES FLYERS

Pilots of aircraft passing the airport. Heston, Fig. will know at a glance whe her they are ahead of schedule or late. A huge clock, now under construction, will make the correct time plainly visible from the air. So large is its horizontal d al that the minute hand will move nine inches in every sixty accords. At noon and midnight the hands are to point due north. Knowing this, a flyer can tell the time even when poor visibility obscures the figures. The photograph shows the big clock just before the numbers were pointed on the dial-





FLYING PLANE REFUELS FROM SPEEDING AUTO

wing gasoline from an autoto me to a meding appliane was a fest 1 Maroc Dry Lake, Calif he other day, demonstrating a new way of ing on the fly. He herto an amplane agat has seen able - an fuel only from another plane har the unusual stan a sor Il sed o od with a special superstructure han he the b se, and contact was accessfully made between p

be fuel (anks had been reple a dy of all was pumped to the plane

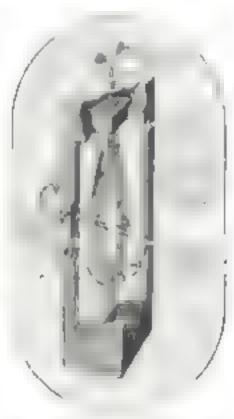
SUBMARINE LIFEBOAT PASSES HARD TEST

Witzwooning Menotal Nanoi, Italianborn American came to Popular Science Monthly five years ago with a plan to save trapped crews from sunken submarines, he had on y a working mand of a valve to exact. It was to he a part, however, of a submarlifeboat for which he had plready evolved complete plans (P.S.M., Aug. 27 p. 151

With the successful test of a two-ton troops of his Invention in New York harhor the other day. Name saw his fream near reasts ion. Entering and sealing the torpedo-like chamber of metal the young inventor was harled into the sea. The champer sank from · w At or nearly half an hear not sed up again and Nanni e reme the worse for his expend est proved he said, that men casabted aubmanne could chi such chappers, seal the engrance and float to the seriace



bont bobs up after



ELECTRIC SWITCH RUNS HUMIDIFIER

INVENTED to keep moisture constant in lamber-drying kans, an au oma ic bydrostat developed at the U.S. Forest Products Laborators will operate any electric humiditier The device is a form of electric switch. Two bowed wooden strips shrink an dry air, starting the humiditier, and spread in moist air, shutting it off

Growing Grass Turns Roof Into a Lawn





FILE HOLDER SHAPED TO FIT THE HAND

A RANDY addition to the tool kit of any carpenter or home workshop enthuseast is a new detachable file holder. The shape of this handle resembling that of a hacksaw is said o elepinate the strain experienced in doing long fling jobs in the usual way hinger grips are shapen to fit the hand. The hande snaps on any five



Erricitacy twenty times as great as that of an ordinary incandescent bulb is claumed for a lamp demonstrated the other day in a New York laboratory Since it turns into useful light an unusually high proportion of the current it consumes, instead of wasting it in heat the bu-b is so cool it may safely be used in motion picture projectors Another applica ion forescen is the projection of the tyleach forages on a full-weed theater screen. The lamp contains mercury that glows through electrical induction when the tube is placed within a coil of copper abing carrying a bigh fre-

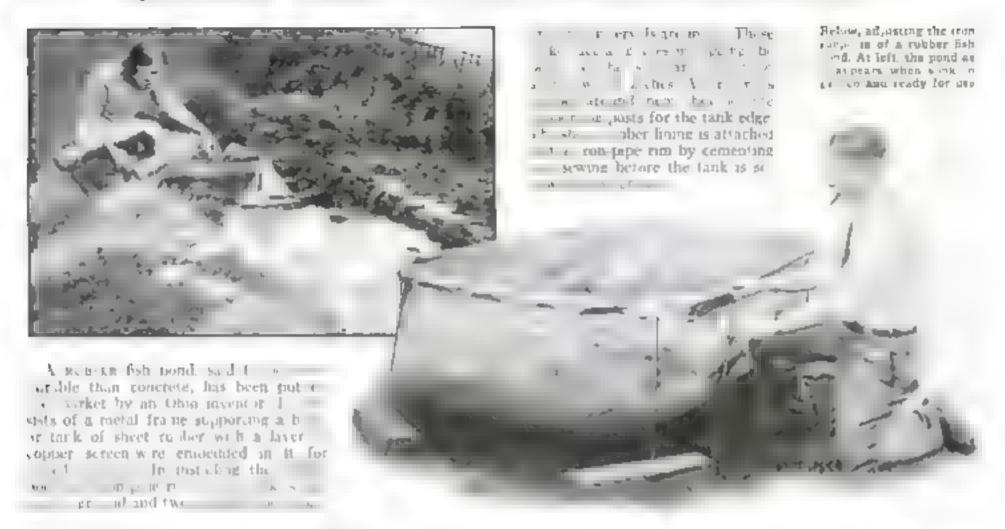


to usy in this large furnishes cold light when the tube seed within a coal carrying high-fraquency current

(w / T 4 4 2 7 T 4 of uper fica ROAD GAGE REVEALS UNEVEN PLACES

Uniconers probably would be mystified to see a man trundling a three-wheeled contrivance of metal, like the one Llustrated at the left, along a freshly-said highway-especially if they chanced to be near enough to hear an occasional "buzz-buzz" from the odd instrument. Actually the tool affords a speedy way of checking up on a new road to make sure that it conforms to specifications. When this "bump detector," as it rolls along, encounters high or low spots beyond the limits of tolerance, an electric circuit is automatically closed and the buzzer sounds. The device is easily portable and may be folded for convenient bandling,

Garden Fish Ponds Made of Rubber

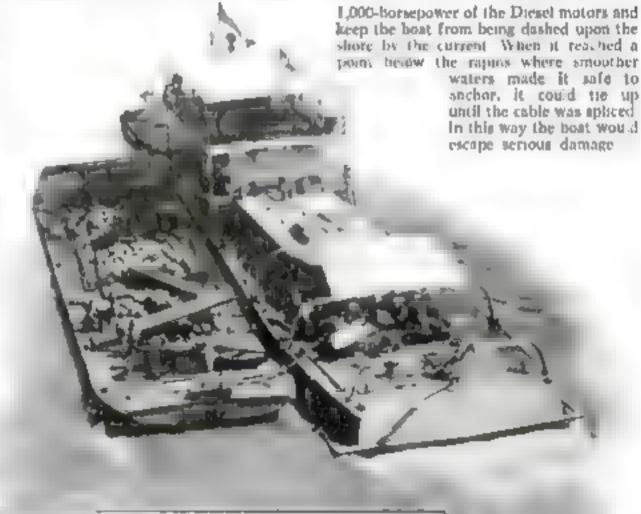


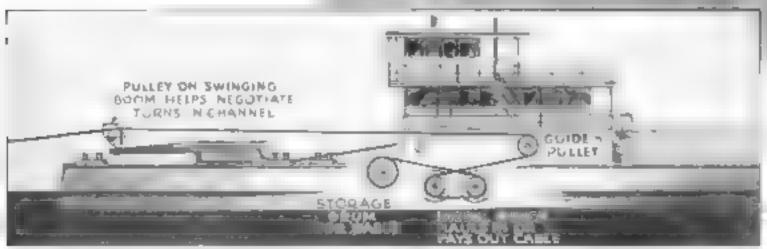
TUGBOAT HAULS ITSELF THROUGH RIVER'S SWIFT RAPIDS

A TUGBOAT that hack itself opstream on a cable is used on one of South America a strangest water routes—a nature la bait streach abreagh reacherous rapids of the Magaziena River, in Colombia, Previously all cargoes had to be trans-shipped by roll ast this point, which was the only unnavigable section of the river for 500 miles. Now the odd Diesel-powered the doat carries loaded barges straight through

Designed especially for its unusual task the tughout, when it maneuvers alone, is driven by four propellers. Auditional traction is needed to ascend the rapids with a

towload, however, and for this reason a 7 200-foot cable was laid along the course of the river and anchored at the upstream end. A motor winch on the tug winds up this cable, enabling the craft to haul itself slowly up the rapids, propeliers churning meanwhile. On the return trip downstream, the winch pays out the cable, A pulley on a swinging boom helps negotiate turns. If the cable should break, an emergency control would automatically unleash the reserve





Tagues above running
the reacherous rap do of
a Bouth American river
using its own power to
make the ascent. At left
drawing shows how cable
a wound in by a Diese.

ByFrederic DAMRAU, M.D.

Life-saving adventures more thrilling than those found in any novel are described in this article which continuos the remarkable story of modern surgery At right, noted surgeon wearing his fluoroscope during an operation



Modern Jurgeons Conquer Fatal Germs

SMALL item recently appeared in the newspapers. It reported a new ruling of the American Colege of Surgeons, In the future, all aurgical thread must be tested thirteen days instead of six to insure its freedom. from germs, That tiny item was bursed in the back pages of the papers. Few people read it. Yet, behind it lies one of the most thruling chapters in the whole dramatic story of death-fighting by surgery

Less than seventy years ago, such a simple operation as the amputation of a finger was a life and death matter. In one famous European bospital, eleven out of seventeen amputations resulted in death from blood poison. Germs of infection were unsuspected. Sterilisation, as we know it today, was unknown. Antiseptica were undreamed of. Doctors knew little about infection and were belpless before it.

It was not until after the Civil Was, that antiseptics first appeared and revolutionized the science of surgery

Before then, only a few kinds of operations were ever attempted. The odds against the patient were heavy and the work of the most skillful surgeon was often undone by swarming germs, Today, with this menace of microbes in the operating room conquered, several thousand kinds of operations are commonly performed and almost daily new feats, that read like astounding fiction, are added to the case-books of famous surgeons.

Witness, for example, this instance coming from Chicago, Ill.

A fifty-six-year-old man was suffering from the dangerous condition known as anuerism of the norta. This means that the main artery, through which all the blood of the body flows, had become flabby and distended. With every pounding heartbeat, the weakened walls bulged outward. At any moment, they might burst and death result. It was as though the man walked about with a cocked and loaded gun pointed at his beart,

On the operating table, Dr. Raymond W. McNealy, noted surgeon, performed a daring experiment that saved his life. Cutting a long incision near the heart, he reached the norta. Then, around this artery he wrapped seventy feet of special gold and platmum wire, about the same diameter as number twenty-nine piano wire, strengthening the walls and holding them in place. Today, with blood pumped to his body through this wire artery, the man is in excellent health!

Some years ago, I witnessed another marvelous operation for the same mysterious disease. In this case, the sorts had dilated into a large bag with the walls stretched almost to the breaking point. In the operating room, I saw the surgeon push a hollow, insulated needle into this bag and then pass thirty feet of fine goldplatinum wire inside.

This wire, unwinding from a spool of approximately the same diameter as the distended aorta, curved around and around within the walls of the cavity. As soon as it was in place, the surgeon attached the outside wire to the positive pole of a battery and placed an electrode from the



A seemingly unimporlant event, occurring about the time Grant met Lee at Appomation, began the transformation that changed such conditions into those of the present, A young surgeon in Edinbuzgh, Scotland, read a pamphlet entitled. The Decomposition of Inorganic Fluids." The pamphlet was by Louis Pasteur. The young surgeon was Joseph Lister, now world famous.

For months. Lister had been spending his spare time peering through microscopes at the feet of frogs and the wings of bats. He was trying to find out exactly what happens in the thin sheets of membrane

Later, he designed a three-legged pump with a long handle, worked by an assistant, which shot clouds of carbolic acid spray over both surgeon and patient during an operation. The spray affected the stomach and choked up the lungs. It numbed and whitened the hands of the surgeon and got in the eyes of the patient, But, in its crude way, it knied germs and saved lives. This wheezing pump of Laster's, dubbed "The Donkey Engine," started surgery on its road to the wooders of today's operating rooms.

His was the "antiseptic method," It concentrated on killing the germs in the wound during the operation, Modern hospital technique has taken another step forward. It employs the 'aseptic method," This concentrates on preventing germs from ever reaching the operating table.

The infinite pains required to make it a success can best be illustrated by taking you behind the scenes and letting you watch, step by step, the precautions taken before, during, and after an operation.

incidentally, this backstage glimpse will

answer some of the common questions people ask me, such as: Why do surgeous wear masks over their faces? What is the longest time an operation ever takes? What would happen if a surgeon died in the middle of an operation? Is everything quiet in the operating soom or does conversation go on?

The work of protecting the pa-





Devices copts a ng charajes a that change color
when subjected to heat
authorate to kill getma
are need to check tha
stor lang apparatus and
that maure germ from inarcuments and dross age.
At top, the attendant to
he ding a giana tube control device and above is
one of cardboard on which
there is changeable ink

negative pole under the pate ent's back. For three-quarters of an hour, the current passed through the wire in the artery. Then, the surgeon removed the electrode and supped off the wire,

leaving the thirty feet within the norts. The effect of the current passing through the bloodstream had been to form clots around the wires made the wals. These clots later hardened into permanent form, resembling scar tissue. This added to the thickness and strength of the walls, thus prolonging the life of the ailing man.

Whenever wires are used in operating rooms, they are always sterdized by boiling them in water or by passing them through naked flames. Nothing enters the awinging doors

of such a champer without a searching inspection. Every bondage, every instrument, every gown is carefully sterilized. By rigorous regulations and unceasing vigolance, the patient is protected from infection in the modern hospital.

Contrast with this the conditions eighty

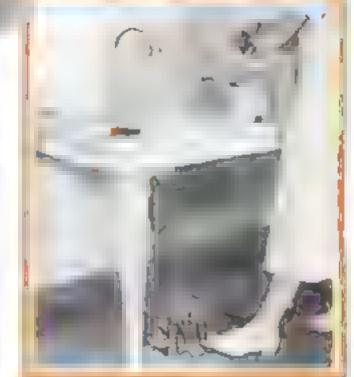
years ago, Common sponges were used to wash out wounds and the same sponge was used on several patients, the physician merely squeezing it out in water between times. Instead of white robes, surgeons were "operating coats," the dirtier the better, as soiled and bloodstained gar-

ments were thought to be an indication of the wearer's wide experience. The nearest approach to protection against germs was a small canopy of linen sometimes erected over a wound to keep out dust.

The manner in which bandages, gover, and instruments are arranged for an operation is shown above. The burse is demonstrating manner of passing instruments to surgeon. At right pedals control weter so nurse does not louch the faucet while washing her hands

when inflammation sets in. For eleven years, he had been searching for a method of making wounds heal perfectly. Theo, in a flash, Pasteur's pamphlet, reporting the discovery that bacteria cause decomposition, suggested the solution. Invisible microbes cause infections! This "germ theory of infection" forms one of the really great discoveries of all time.

Lister's first step in combating nucrobes was the development of a "catbolic acid putty" for sterilizing wounds.



night before the operation. The spot where the incision is to be made is washed off with hot water and tincture of green soap, Then all hair is carefully shaved away, the spot is again washed with alcohol, and finally covered with a sterile towel. The next morning, alcohol is again applied. then ether, to dry the skin, and lastly iodine, or in cases where the slun is tender and will be burned by todine, a combination of pictic acut and alcohol,

Clad in a sleeveless flannel chest protector, or "ether jacket," and long woollen stockings, the patient is wheeled into the chamber where the anesthetic is administered. This is usually a small room connecting with the main operating room. Alt jewelry has been removed. Even wed-

ding rings cannot be worn into the operating room, When patients object to this rule, the rings are sometimes steri used and secured to their wrists.

In an adjoining room, the surgical team is getting scrubbed up for the operation. Hands and arms, to a height of two inches above the elbows, are washed for ten minutes with hot water and tincture of green soup. Washstands are equipped with foot or knee levers for regulating the flow of water so the hands never touch faucers. Sterrised white gowns of lawn or musho are then all poeu on and caps are pulled into place covering all the hair Masks of gause, five or hix layers thick, cover the mouth and note to prevent the breathing of a nurse or surgeon from carrying germs into a wound. Every member of the team must be in good health and free from colds.

sterilized rubber Extra-strong gloves cover the bands. They have been soaked in a five percent carbolic acid solution for two hours and then powdered, Each glove is blown up and tested for leaks before it is used. Even a pin-prick cannot be disregarded. Germs from the hands might work their way through it into the wound for, no matter how long they are scrubbed, bands never become surgically clean. Again, virulent pusfrom a suptured appendix or other infection might find its way into the faulty glove and endanger the life of the surgeon.

REMEMBER one dramatic moment of the sort in an eastern operuting room. The famous surgeon, Algernon Bristow, was performing an emergency operation on a palient with a ruptured appendix. As he removed his scalpel, dripping with put, the razor-sharp edge flicked across a fingertip, shitting the glove and the skin beneath. The operation was at a critical point. He dare not stop even long enough to change his glove, for the primal law of the operating room is The Patient Comes First. He realized his danger but we saw him tighten his lips and go on. By the time he had finished his work and sterilized the cut, the germs had entered his bloodstream. That was the last operation he ever performed. A week later he was dead.

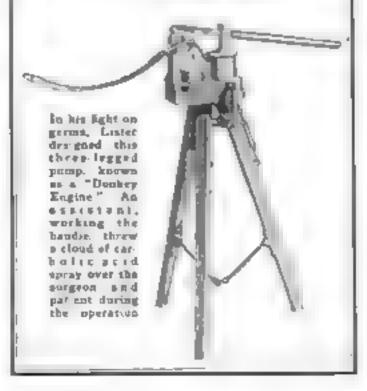
Nothing in the operating room is touched by any one except those who are scrubbed up, that is, completely sterilized. An unbroken aseptic chain must be maintained in handling every object. If an instrument drops to the floor during twenty minutes, except in extreme emergencies when it is sterilized by passing it several turnes through the flame of burning either changed or sterilized, Gowns, gloves, instruments, and triensda are all shifted as an added precaution against infection.

drilled like soldiers. Wartime discipline rules in the operating room. No one speaks except the surgeon and the anesthetic ex-

an operation, it must be reboiled the full alcobol. Between operations, and often between two parts of an operation on the same person, everything in the room is THE members of a surgical team are

JOSEPH LISTER First to Use Antiseptics

Seventy years ago, even trifling operations were highly dangerous. It was not until Joseph Lister, noted English surgeon, developed his germ theory of infection that surgery came into its own. As a reault of his crude efforts, sterilization now keeps all germs out of the modern operating rooms.



pert who reports on the breathing and pulse of the patsent, Every operation is a race against time, some lasting more than three hours, so there must be no confusion, no waste motion. Each member of the team has a definite duty to perform.

One nurse is responsible for the proper placing of the patient on the operating table and the adjustment of the lights over it. Another does nothing but remove lids from basins, piace buckets and fill pitchers. The suture nucse hands instruments and sewing materials to the surgeon, always holding in reserve a duplicate of the instrument he is using so in an emergency, it can be replaced without an instant's delay. Another member of the team is detailed to check the sponge count, mak-

ing sure none of the gause pieces are sewed up inside the wound.

A fifth nurse presides over the autoclave, the polished metal cylinder in which gauze, bandages, and towels are sterilized by steam under pressure. Increasing the pressure in the chamber raises the boung point of the water. At twenty pounds pressure, for instance, water, which ordinarily boils at 212 degrees F., requires 260 degrees, thus increasing the heat to which the microbes are subjected.

The work of the autoclave nurse is of key importance, I recall the terror that seized us, some years ago, when three successive cases leaving our operating room developed infection. We appealed to a bacteriologist Like a detective, he traced the miprobes to their source. Gause dressings, applied to the wound after the operation, had not been sterile. A nurse in charge of the autoclave had hurned them through the sterilizing process, saving a few minutes at tremendous expense.

NOWADAYS, to insure every bandage is completely sterile, changeable ink is placed in the chamber, It alters its color only when it has been left in the autoclave long enough to kill all possible germs of infection, Diack controls, small glass tubes conlaining a substance which also changes color with adequate sterilization, are similarly used. In addition, cultures of live germs are sterilized in the autoclave once a month and then exammed in the laboratory to make sure all microbes are being killed.

Overseeing the work of the team is a head nurse who gives the final O. K. to the apprope count and is prepared to assist at any post during an operation. One of her duties is wiping the face and brow of the surgeon. A single bead of perspiration falling into an open wound would carry germs inside and undo all the precautions that have been taken. The temperature in operating rooms is automa. 1cally kept at between seventy-eight and eighty degrees F To absorb perspiration and protect patients, many surgeons place pads of forded gause over their forebeads under their sterilized caps.

Standing beside the surgeon, during every serious operation, is a second surgeon, ready to assist him or take up the work at any point in an emergency (Continued on page 94)

Ghost Ship Bombed by Navy Planes



Man-Made Lightning Shatters Big Redwood Timber





a new machine. At right, expects training timber characted by the rightning

Man-made lightning of J,000.000 volts shattered an eighteen-foot, four-by tour timber of redwood in a spectacular denionstration of a new high-voltage machine at Stanford University the other day. The apparatus operates on the principle of a Leyden jar, storing up electricity in a huge condenser and then liberating it all at once

in a blinding discharge. It will be used to find the best type of insulators for the high-voltage transmission lines from Houlder Dam to Los Angeles, Calif

STEEL GRID IN ROAD ENDS SKIDDING

Zig-tao metal frameworks that suggest grids for reasting meat are being used in Austra to produce highways with non-skid surfaces. After the road has been leveled the steel reasting grid is placed on top and gravel is pounded into the spaces

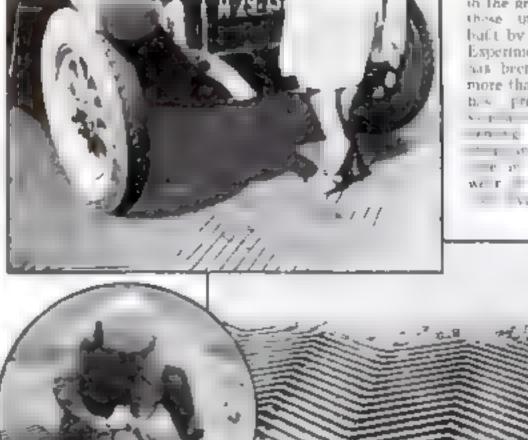
between the bars. These sig-sag bines of steel, protruding slightly above the gravel, give the surface of the road a tread that prevents skidding. At the same time is mad, they lengthen the life of the highway and prevent the formation of ruts or

washboard depressions in the gravel. One of these unique roads built by the Austran Experimental boxety has been in use for more than a year and his proved highly and a series of the austral to a series of the



WINDOW CLEANING BRUSH IS WHIRLED BY MOTOR

EVEN the task of the window washer is now made easier by labor-saving machinery. An electric window cleaner devised in England assures a thorough and a fast job. Its revolving brush of felt, mounted on a convenient pole, is spun at high speed by an electric motor. As shown in the photograph above, the device is sufficiently light to be handled with facility

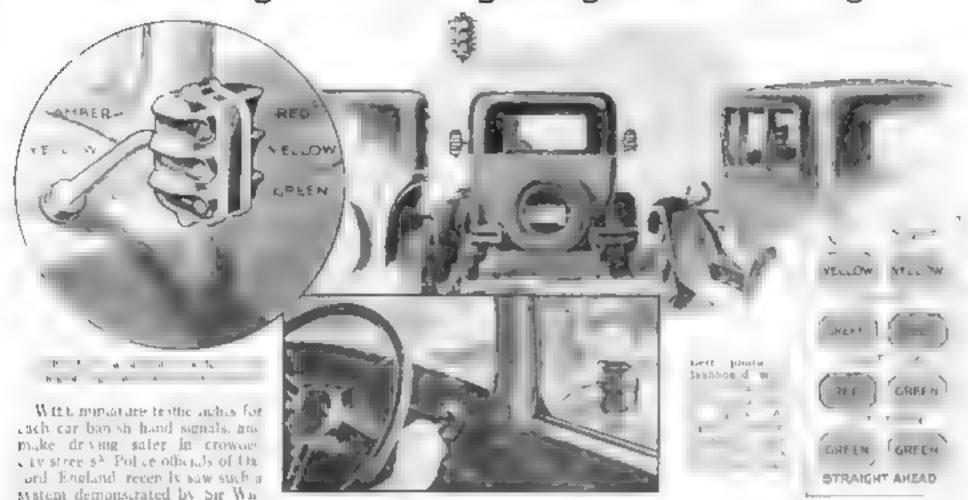


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rated makading A on saw must be no should add and an expension of the and and a street with an

country to bare of a community of the salway

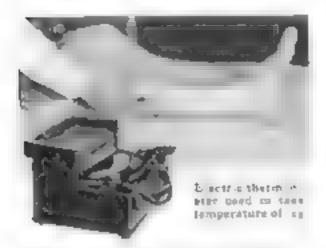
Traffic Lights on Auto Signal Right or Left Turning



liam Morris, motor car thaker.
Installed in pairs one on each side of a car and operated from a dashboard switch the new lights use stop and go samals familiar to every motorist to warn of turns and other maneuvers. To signal a left turn, the lights first show yellow on both sides—a caution a goal. Then they change

automatically to red at left and green at right. The reverse of these signals is used in turning right or in pulling over to the right-hand curb to park. An all-green signal, straight on, indicates the driver will not turn at an important intersection signals are visible from front and rear

the front of the red light being shaded to amber because motor laws forbid a red light facing ahead. An automatic timer in the control switch makes each signal flash several times and then puts the light out without any further attention from the driver



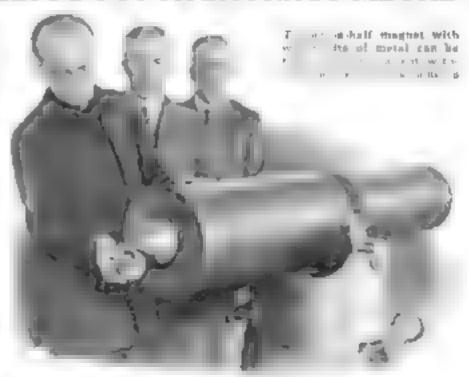
ELECTRIC PAD SHOWS BODY TEMPERATURE

A CLINICAL thermometer held in your mouth, if you are healthy, will give a reading of ninety-eight and six-tenths degrees. That does not mean that your entire body is at the same temperature as it may vary at points on the surface.

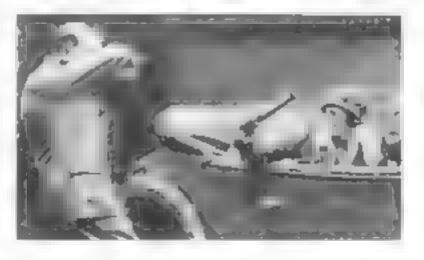
Physicians must often know such temperatures with precision, and a new instrument designed to help them was demons rated a few days ago by engineers of the General Electric Company, Known as an "electric resistance thermometer," this instrument comprises a defector pad about an inch square, an electric meter dial, and a plug for connection to the usual 110-volt house current supply. When the detector pad is placed upon the patient's body, the electric dual indicates the temperature to within less than half a degree F. The meter is actuated, in response to body warmth, by the altered electrical resistance of many turns of fine, insulated copper wire on the detector

MAGNET HELPS DOCTOR EXTRACT METAL

FOREIGN bits of metal may be removed from the throat, thest, or abdomen of patients with a manimum of laceration, surgeous predict, with a tonand-a-half magnet just completed for the St Louis University Medical School, A fitty horsepower dynamo furnishes electric current for the giant magnet, which. watbout difficulty, can lift a metal operating table from the floor It has been used to extract metal from patients' eye -

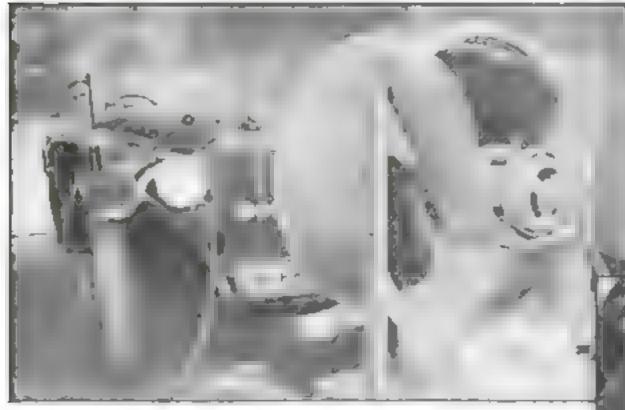


WEAPON FOR MOTORISTS BRANDS THUG WITH DYE



A NEW weapon for the protection of motorists and shopkeepers not only subdues the most victous thug, but also brands him for identification in case he should escape. When he is struck with the club-shaped weapon, an airtight membrane breaks, releasing a chemical similar to tear gas and also a spray of aniline dye that indebbly stains his face, hands, and clothing thus identifying him.

Autos Run on Treadmill in Accurate Speed and Fuel Tests



With a gale of wind rushing past, German cars now roar at mile-a-minute speeds on rolling roads and never move an inch. The scientific treadmills were designed by automotive engineers for super-accurate tests of high-grade cars. The rear wheels of the machines, splinning on revolving rollers, meet with conditions that remain exactly the same throughout the tests thus permitting a more accurate record of performance and fuel consumption than can be obtained on ordinary highways. During the experiments, a huge electric ian, facing the cars, sends a gale of cooling wind through the radiators.

BLIND HEAR PRINT AS MUSIC

avention, called the "optoka to the blind. A book to be read is placed face down upon a rest at the top of this device A scanning disk and an electric eye, or photo cell, detect the form of each letter and produce a musical equivalent. Thus a capital "I" is heard as a thord of four notes. A capital V' is represented by the same notes, beard one at a time. Blind students are said to

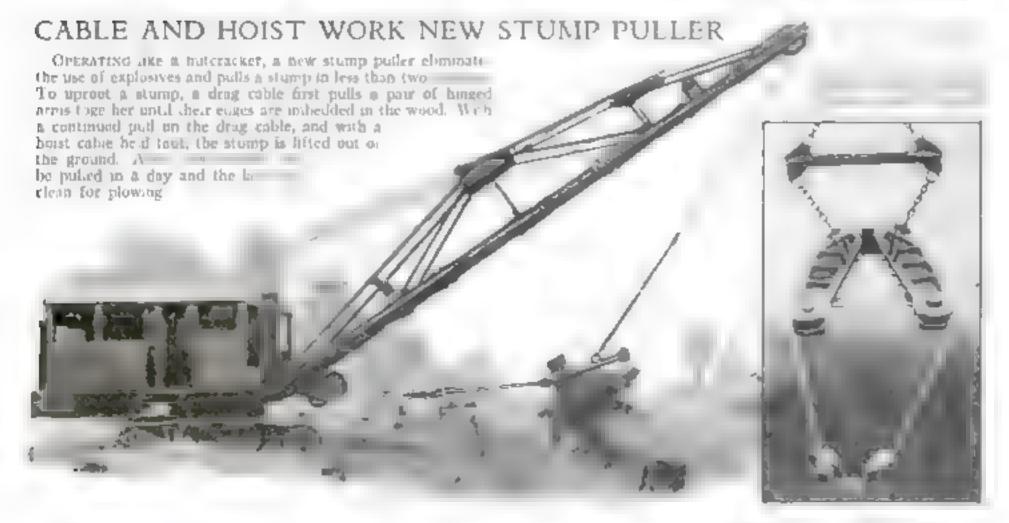
learn to interpret the

sounds readily.

printed letters into musica!



Reflers set in this treadmill receive beneath the fear whosis of an auto during speed and fuel twise At upper loft, big elects a fan aending go's of wind through car's reductor white it runs on treads I



Automatic Bridge Table Shuffles and Deals Cards

shuttles and deals the car is anteshuttles and deals the car is antebly and rapidly is this accompis dealt by the time the used pack has thus speed by up the game and making and materest be. Any household omlet fur tren for the labe. The heart of its remark our mechanism is a tiny electric moof its own accord when a pack is inset.

1



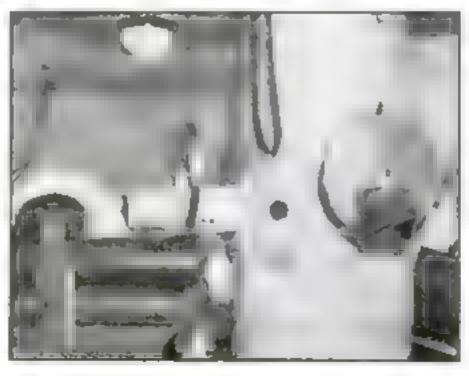
tem picks up to read deavers ther a sens in from the lone by discrete mg them ad of an rotation, stopping when each player has thateen. The language is a strayed that nothing a fair uca concrent bands of thereen cards an be dealt by the machine one have bring as lakely as another to appear

TREAT CANCER WITH BIGGEST X-RAY TUBE

TREATMENT of cancer patients has just begun at the California Institute of Technology, after months of preparation, with the burgest X-ray tube in the world. Artificial lightning of 1,000,000 volts operates the thirty-foot instrument. This is the highest voltage ever harnessed for medical use, and spectacular displays of sparks are to be seen in the adjoining room where the current is stepped up by two transformers. Radiation from the tube is declared more powerful than the rays that would be obtained from all the radium in the world. The imprecedented voltage gives the rays extremely deep penetration. Rats were subjected to the rays in lengthy tests before the tube was applied to human beings

ELECTRIC PLUG CONTAINS FUSE

A satory circuit in a household aron or toaster will not plunge the room at o darkness when a new connector plug is used. The plug contains a pair of transature fuses of such a rating that they will blow, and thus disconnect the applicance from the household circuit, before the fuses in the main wiring system are affected and the current supply rat of





Windows in the vertical thirty-foot tube. left, emit X-rays to free cancer patients. Above, million volt discharge from machine that rong the big tube

New Auto Tire for Heavy Machines Contains No Air



This took grading machine is equipped, to absorb shocks, with a recently designed tire in which there is no air pressure

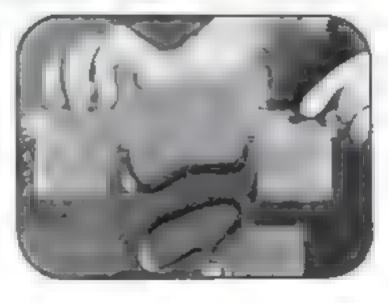
FLAT MICROPHONE HELPS DEAF HEAR

By ENABLING people to hear through their bunes, a new electric invention aids the partially deaf. The device consists of a flat microphone not much larger than a spectacle case, that may be concealed beneath a dress or in a pocket; a small ha terve and a triv electric oscillator that s set at vibra at by the sour is received In the microphone. When the oscioator is held against the forehead or pressed he head just behind the ear any work spoken nearby is heard distinctly by the user. The oscillator may be ween with a he and or hang take a renecklace. The latter method is the one illustrated below. According to Dr Hugh Lieber, the inventor, the device will enable many deaf persons to hear



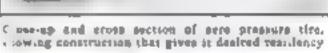
PROFILE GAGE SHOWS OBJECT'S SHAPE

HANDY in shop and factory is a new profile gage with which the contour of any object may be temporarily or permanently recorded. In use, a tension put is loosened and the laminations of thin metal that compose the gase are pressed against the object until they take its shape. The nut is then tightened and the instrument removed so that the pattern may he transferred to paper, wood, or knowum. While the device is especially intended for carpenters and machinists, others will find it equally useful.



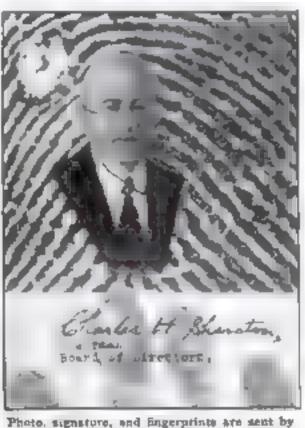
WITH low-pressure balloon and super-balloon tires for cars gaining in popularity, the intimate has now arrived in a tire that carries no air pressure at all! However, the new zero pressure tire, as it is called, has far more resiliency than one of solid rubber because of its peculiar con-

> struction, as seen in the photographs. It does not bounce when it encounters an obstacle, but rolls smoothly over it. In soft soil or sand the rubber tread assumes a concove profile, packing the material under the center of the tire and riding along with a snowshoe effect The tire is especially adapted to use on roadbuilding and agricultural machines and for all others engaged in heavy hauling on uneven roads.



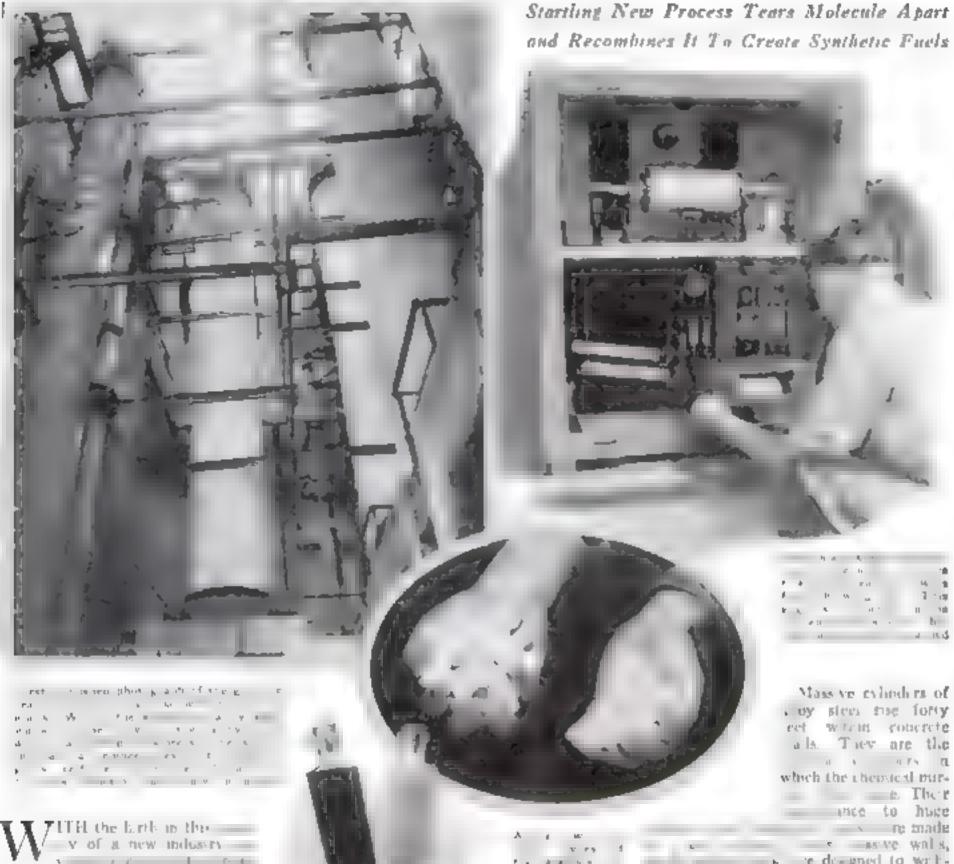
POLICE USE RADIOPHOTO

SENDING photographs by radio is the new quick way of identifying criminal suspects. A demonstration of the method was given recently in New York by the National Identification Association. A man's photograph, his signature, and samples of his fingerprints were transmitted by radio upon one card



Photo, signature, and fingerprints are sent by radio in latest method of identifying suspects

Oil and Kerosene Made to Order



them a taker-made mater of a term of the mater is written in the drater of the ory of "hyperogenation of the word war for Germany. It enabled her chemists to make explosives for her big guns with introgen captured from the air, after Albed blockades that off her supply of Chilean intra es. Mystery still clung to the process years after the war. Industrial chemists, seeking peacetime applications, guarded

How far it has been developed at the Bayway, N. J. plant of a great oil company is revealed by a recent announcement. Its engineers now literally tear apart molecules of crude oil and re-form them at will into new and valuable compounds, of which four are already being manufactured on a commercial scale. They include a synthetic motor oil said to be especially

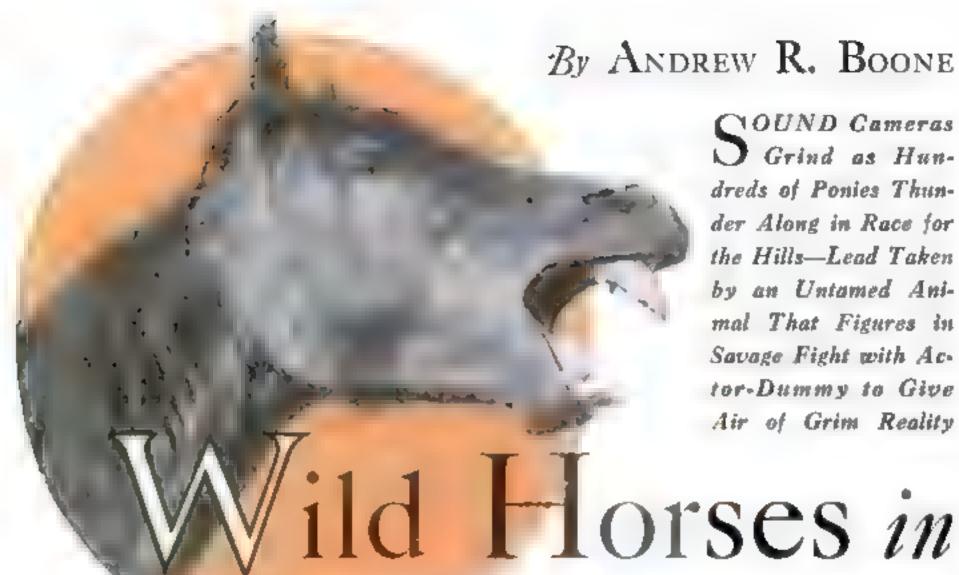
adapted to the high compression and power of modern automobiles, a hydrogenated "safety fuel" for aircraft and motorboats; a superior, synthetic kerosene; and a series of hydrogenated solvents for the point, varnish, and other industries. Soon to appear on the market is a hydrogenated aviation oil

What is hydrogenation? To the chemist, it means a process in which hydrogen gas is forced into reluctant chemical combination with nitrogen, with coal, or with petroleum, to form brand-new substances. To the layman, as applied commercially at the Bayway plant it takes on the fascination of titanic forces at work,

which the theorical nurse. The reserve to have to have to have walk, to desent to well
are than and temperatures of 750 to the are than and temperatures of 750 to degrees as the hydrogen and petrosed to degrees as the hydrogen and petrosed to the substance, resembling lamps of sugar, that, mysteriously as hing to the reaction, is af erward recovered out the loss of any of the substance.

If only five percent of oxygen entered the reaction towers, they would be likely to blow up. Special oxygen detectors constantly stand guard over the daily stream of \$,000,000 cubic feet of gas—about the same amount that is consumed by the whole population of Cambridge, Mass,—that is pumped into the towers. Before the oxygen proportion ever becomes perilous, a siren sounds and the tower is shut down until cleared of its contents.

Successful laboratory experiments presage new wonders of hydrogenation. When wells have sucked the earth's crust nearly dry of petroleum, hydrogenation will turn coal into oil, and oil into gasoline, as small-scale tests have shown



dreds of Ponies Thunder Along in Race for the Hills-Lead Taken by an Untamed Animal That Figures in Savage Fight with Actor-Dummy to Give Air of Grim Reality

COUND Cameras

Grind as Hun-

ICHTEEN hundred wild bornes recently atampeded down an Arizona canyon to provide a thribing climax for a Hollywood talkie. In the picture, they thander across the silver screen for only a few tense moments. But to make those moments possible, half a bundred Navajo Indum wranglers, a dozen veteran cowboys

more than two miles of wood and buning fence, and a trained "wold stallion of the studios, were required.

For weeks before the cameras arrived, the Navajo wranglers were scouring the bare uplands along the Armona-Ltan burder, driving the wild ponies southward, berding them into Blue Canyon, 150 miles north of Flagstaff. Lured by an offer of two dollars a day for each man, fifty cents a day for each saddle horse, and ten cents a day for each wild pony, the Indians moved to the canyon, bringing families and baggage, ready to stay as long as they might be needed.

One end of Blue Canyon is a pocket in the hills which forms a natural trap. Across the narrow entrance a heavy forty-

Here they summed A best of wild borsen thundering down the valvey, awarp peat the comercia and are cought for the acreen

foot gate was built with 200-yard wooden fences extending out fan-like on either side. From the far end of these fences, barriers of bunting were carried on for nearly a mile. Thus, once the stampeding borses reached the wide mouth of this funnel, I was told as I watched preparaions for the filming, they would feed down it into the trap, Four miles away, at the other end of the canyon, hity riders granded the milling, restless pooles night and day until everything was ready

The script of the picture, Columbia's "Wild Horse Stampede," called for Rex, the trained twelve-year-old stallion, to turn the stampeding berd back from sure capture in the trap, prepared by brigands who are attempting to round up



Earl Haley, told me he counted on the stalbon's natural intelligence and leadership to halt the stampede in its headlong flight and turn the charging herd back away from the trap. During the



Stampede for Movies





Earl Ranky and park one or an or store to be

THE TOTAL THE STATE OF THE STAT

Rex sees the wooden fence and the fiery little brack wheels to one side like a cat. With the the whole herd swirling in his wake, he swings to the left. In an instant, the ammals are thundering back again along the canyon while the whirring cameras swing to parture their retreat Everything has worked out just as had been planned

The next day, 600 horses were cut from the herd and preparations made for a second stampede. In this case, another Hollywood horse, Marque, was to betray the band and lead it into the trap. At the last moment there was some delay at the cameras. The horses grew restless. Suddenly as the ten riders strained to bear the starting gun, two of the animals began to bue and lack. Others in the vicio is a raggling to escape, started up a nearby hill. In a few moments, the whole 600 horses were in mad flight up the precipitous cliff

NEARLY 300 feet they climbed, their hoofs catching in little rainwashed crevices that lined the face of the hil-The crest offered them no haven of safety however, for those behind pressed the leaders, forcing them down the other side which was so steep the ponies sat on their maunches and laterally slid to the base

The ten riders had no way of reaching the escaping horses. Their means a continot carry them up the steep incline. Finally, a lone Indian rode his mustang upthe cliff. He found the other side was too steep for his horse to carry him down and had to dismount and slide ahead of the pony to the bottom. In an hour, by hard riding across the plain, be rounded up the hand and herded it back around the end of the chill from where the cowboys drove the animals back to the starting point,

N SPITE of their wild scramble up the cliff and their long run across the plain. he wiry lattle horses were ready for the dash down the canyon and an hour later were milling, kicking and crowding within the enclosure of the trap. As soon as the thumping and squealing of the captured horses had been recorded through the microphones, they were released. Haley knew that after the wild horses had been trapped once, they could not be enticed near the enclosure again

Another 600, the following day, were berded to the starting point. This time Rex was scheduled to run in from the sidelines just as the hand reached the wooden entrance, and again turn them back from the trap into which they were headed.

No Hollywood actor could have performed his bit with greater sureness, Inthe distance, Rex could hear the swelling thunder of hoofbeats. His neck arched-

his feet stamped the

dashed the stalison. Directly in the path of the corushing herd, he paused, head high and eyes wide. With a quick glance toward the trap, he took rapid flight in the opposite direction, wheeling the herd in his wake

Later in the filming, with all the ferocity of actual conflict, the black stallion demoushed dummies of a lion and a man,

In the latter case, a trick added to the realism of the scene. The villian of the talkie is shown riding one of Rex's two doubles. The horse shies and throws the rider As though the real killer-horse, Rex, were after him, the actor races for a protecting cliff but falls just before he reaches it and lies very still.

AFTER the cameras have recorded his fall, a dummy is placed in the same. position and Rex enters the picture, One cue that acways enrages Rex is for Landal. to point the stock of his whip at his face. His eyes flash, he bares his teeth, and advances toward the trainer. But when the whip is reversed, he always follows the direction the whip points. Now, after leaving Rex and going through the motions of kicking the dummy, Lindall pokes his whipstock toward the horse. It rears and seems to anari. Before its mood can change, Lindail points toward the dummy.

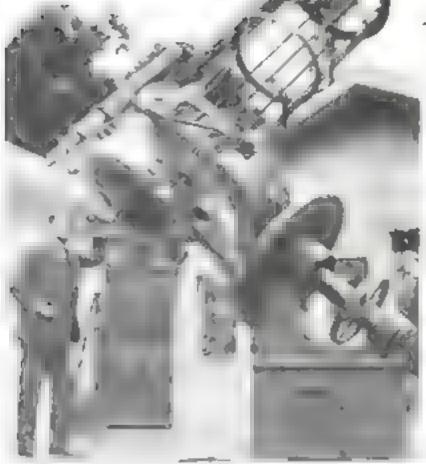
Rex rushes upon it, ninks his teeth into one boot and burls the body high in the or Hot Wy has the daymy struck the before the coal-bia it ata in a mek wall hering and le aung

> wild hersen pounced, we envirgparating past catherine of macreall he wild poster w tirth to his r hapt you



UNUSUAL OBSERVATORY HOUSES

Amateur's Big Telescope



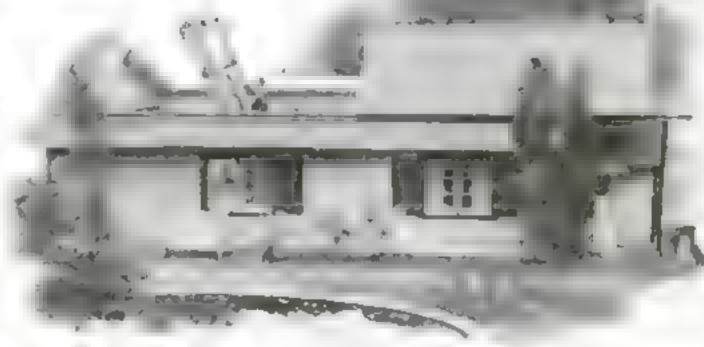


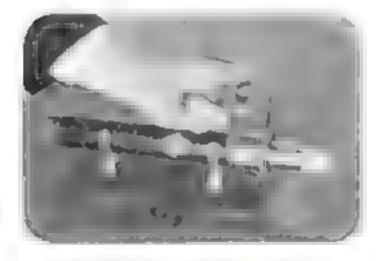




O HOUSE when is called the argest telescope of its ty-in the East G. W Cook the eur as conomier of Way wood Pa., has constructed a vate o servatory. When he w to look at the stars he gaves a few arns to a move ed steer be hees made ed on a peril. The whole roof site at of the way on heava trings. Despue the 1gh weight aloy used in it carstraction, the two eight-and-a-half-anch, than rier te escupe weighs for ons. It has the power t enlarge an object 1-k times. By a near his dwe ng the observatory as-

venient for Cook's use-





FLASHLIGHT PROJECTOR

Built like a flashlight is a new portable projector designed to throw single frames from standard motion picture film on any convenient flat, white surface. Striking views may be snipped from movie fams and exhibited with this device in the manner of a home lanternslide show. Dry cell batteries of standard flashlight type are used in the projector, which may be held or snapped to a stand as shown.

KANGAROO CAN JUMP 38 FEET

WHAT is the kangaroos greatest jump? Recent observations by reputable observers credit the animal with leaps of thirty-eight feet, and the three kangaroos in the photo at the right, snapped during an Australian roundup a few weeks ago, seem well on their way to match the record. Tremendous development of the hand legs, as compared with the front ones, accounts for such jumping ability. So swift is the kangaroo, bounding across country in a series of leaps, that it is raid to be capable of outdistancing a good horse The animals are regarded as pests in Australia.





NEW MOTOR FOR COACH IS FLAT AS A PANCAKE

FLAT as a pancake, a twelve-cyander rene for motor coaches was tested recently in a Cleveland, Ohio, factory The cylinders are horizontally opposed so its total height is only sixteen inches. Thus, designers will be also to attlize all the floor space in a coach by placing the engine, and all its accessories, beneath the were machine. The first coaches we to by the pancake power-plant a hill car a pro- about the

BANK'S BLACK BLOTTERS PREVENT FORGERIES

If was do ters now for a .. ers in a Scattle, Wash, bank tl crook could follow a deposit of a secnd study his revers to a co-- dorter he has -In p the agnacia is



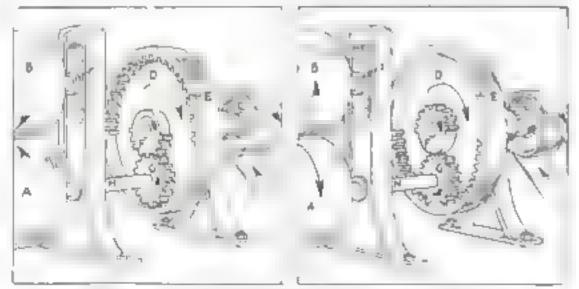
to the second

a section of the top above the

ENGLISH CAR HAS DOOR IN ITS TOP

> ong ago, it a tracted ittertion, growds gathering around the stand to waich the soof door or or the property of the

MANGLE ROLLS CHANGE DIRECTION



Diagrams showing how mangle goars must be made to much and diseasage so he to is wall turn slowly inward and reverse to turn outward with a much faster motion

Hene is the southon of the Can-You Invent It? proteen published in November In the problem you were asked for the bes way on he mangie rolls turn slowly in and then reversing the r mot on, turn rapidly out Necessary gear modifications with the action produced, are shown in the diagrams above. It is evident

has the power transmitted to disk D causes the rose to tern stowly inward. when G is in mesh with F. When the teeth of & teach the toothless part of F and start to mesh with the inferna gear ring E the direction of the roles is reversed and the larger number of teeth in E will speed up the motion of the rislers

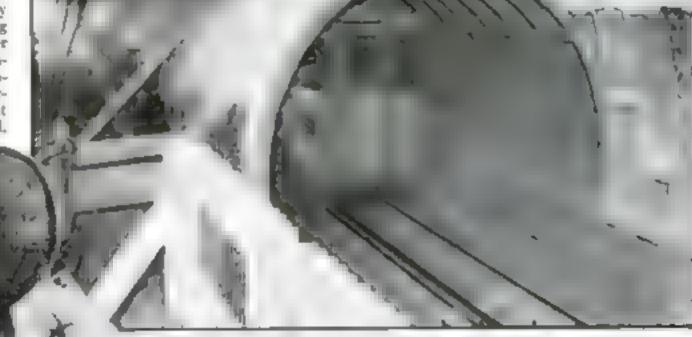


STEEL BAND MAKES ODD CURVES EASY TO DRAW

Our setapito curves, beyond he draftsman's range with ordinary drawing instrumen's are castly reproduced with the aid of a novel tool By varying the post ion of a sliding anchor and locking it with a seisures a band of signly as omatically formed men one of a practically introde number of curved shapes Roober backing jorns a rest for the fingers. At also grips the paper. Sizes with a working edge. up to thirty-eight inches long are available.

Trains Never Stop as New Subway Is Built Around Old One

BUILDING a new subway around an old one, without disrupting train service, was the remarkable feat accomplished in London, England, naring the recent rebuilding of one of the stations. The striking view reproduced here shows the task partly finished, with a train just passing through the half-demolished older tube. By doing most of the construction work at night, it was completed without even seriously slowing up the train schedules and at no time was service actually slopped.



This consult photo shows the new subway that is being built is London around the old tube, each of which is seen in picture, without interfering with the train service

MIDGET REFLECTING CAMERA

So compact that it may be carried like a handbag when folded, a new reflecting camera dispenses with the bulk usually characteristic of this type, while preserving the ability to view the picture full size and right side up until the moment that the shutter is snapped. The midget model takes a picture two-and-a-quarter by two-and-a-half inches to size. It is equipped with a fast F/3.5 lens, and a focal plane shu-

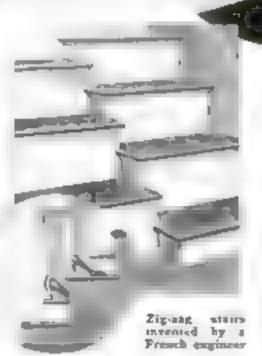
an larger models. An autorum case in built into the camera which therefore deciss no other carrying case

SUIT GUARDS BOMB OPENER

Dressed in his official costume, the German police officer charged with the responsibility of opening bombs found in the mail looks like an ancient warrior clad in armor. The mask and padding are designed to protect him if an explosion should occur, despite his delicate handling of an infernal machine. In the illustration above, a suspicious package is being opened.

ZIG ZAG STAIRS SAVE FÄTIGUE

WHAY is said to be the first new invention in starways in 6,000 years, has been announced by a French engineer. His stairs may be visualized by imagining an ordinary fight of steps sliced vertically in two, and one of the two narrow sections raised the height of half a step. By stepping alternately on each side, according to the inven or, the user lifts his weight with less jerkiness and fatigue. The stairs are also more compact than the usual type.



Midget reflecting camera above, no it looks ready for use and right, when lolded compactly like a handles

PLIERS REMOVE WIRE STAPLES

REMOVING wife staples used in holding papers together, without damaging them, has been made easy according to the maker of a new tool. Extending inward at right-angles from the end of one jaw is a shovel-like projection which slips beneath the staple. When handles are then squeezed together the jaw pulls the staple



PICKED MEN trained to lead

Our Police of the Sea



Federal Government workers or putting the fin shing touches on a scheof garning that is the only one of i and in the wor 1.

In this pay \$2,500,000 Cc. Academy, packed young men fr he country will be train bergs and smugglers, handle slin . high seas, save lives and property fr he fury of the deep. Theoretical militar and technical training will go hand in hanwith shop and laboratory work, gun pretice drills, and none mouths of seaman ship on the ocean

When a man finishes credital 5 the scribed course of instruction on this ut instruction he will be not only scaman and marine engineer, but asso a responsible officer capable of carrying on the countiess tasks assigned to the Coast Guard

Conducted on barkentines and barks steel cutters and schooners, with drill and classroom work in temporary but ongs on shore, a school for he special training of others in the daties of the Coast Guard has been in existence since 1876, when a two-year course was established aboard the inpsail schooner Dobbin, of New Bedford Mass. Old Fort Trumbull, overlooking the mouth of the Thames and New London harbor, has served as the land home of the Academy since 1910.

Coast Grand cadets, on training crosse, find a disabled American ship and tow it into part

The new Academy differs from this school of an old day in that it is a beautiful, permanent institution, comparable with the the famous academies of Annapoles and West Point

Opened scarcely two months ago, the buildings already burn with activity There, four classes, totalling 132 men. study mathematics, dissect engines, overhaul boats, discuss the niceties of international law, and learn to shoot the stars, Schoolmasters are regular officers of the service, selected for their alulity to handle

men and to teach. The course of four years prepares a cadet for both line and engineering duties. Next May the present upper class will be graduated, next June youngsters a every state of the Union will be comming for acmission.

Although it costs nothing to get the four years of training in the Coast Guard Academy, the requirements are rigid. To be eligible for admission you must be an American citizen, between the ages of eighteen and twenty-two, unmarried, physically sound, constitutionally strong, and



have a high-school education and at least a year in coalege. Possessing these qualifications, you must pass an examination in history, mathematics, and English. Not the easiest of all, you must finally convince the examining board that you have those qualities of character and maniness that would make a good officer.

one of the big guns mounted on the cutter's deck

Examinations are usually held during the middle of June, and in most of the large cities of the country. If you are appointed as a cadet, your transports ion will be paid to New London. But do not be over y disheartened if you are not On y f. ty-one of more than 800 applicants. who look the examination last spring passed. The Academy was really anxious to obtain about sixty.

To many, the Coast Guard is a child of the rum-running war. Actually, under the name of the Revenue Cutter Service, it is nearly 150 years old. Alexander Hamilton and George Washington were its first sponsors. An Act of Congress in 1790 brought it into being to suppress pirates and strugglers.

At his time merchantmen of the United States were being harried by privaluers of France and England. Against these men-o'-war was sent a small fleet of cutters, the largest carrying seventy men and fourteen guns. Urged on by the indomitable crews of the new service, these little vessels captured prize after prize, and finally succeeded in driving the marauders from our seas.

What of er of the service cannot recad the through recerd rolled up by the cut er Prokering during the difficial ex-· 7 297 In Laws when fighting consisted of groadside against broadside, en enemy ships went down refere her guns and crew, ond of them a frigate of forty-four guns and 200 men!

It was the Revenue Carter Service that fought the bioody par les with the pirates of the Spanish Main. When Jean Lat harge, ex-housement of the notorious Jean La Fi te, attacked he cutters Lemmana and A

hama with his powerful pirate ship Braziand tried to force them to accept defeat, be was due for the surprise of his life. Suddenly becoming the aggressors, the dauntless cutter men boarded their pirate captor, carried her decks in a furious hand to hand fight, and hauled down the July Roger of her cut-throat crew!

Such thrilling episodes marked the beginning of a service that during its entire history has been characterized by exploits of beroism and daring. In every war but one in which the United States has particspated and in its battles to save lives and ships from the sea, the Coas, Guard has steadily added distinction to a situations.

Some of the most arduous battles of this strange peace-time navy of the Treasury Department are still with the smuggier Today the rum-runner predominates, but the aben and (Continued on page 92)





Fire fighters wearing ma musks, estinguished fake flames the ing an air raid rehearsol in which all the citizens of Stone took part

over the city of Rome in a series of three mimic air raids a few weeks ago, the half million inhabitants did not terrain on the sidelines as speciators. By Government edict, the civilian population participated in the unusual rehearsal. The result was a giant show so impressive that many thought was actually had been declared

Shortly after ten o'clock one evening, the whine of airens and the lattoo of anti-aircraft guns announced that bombing planes of the "invaders" were approaching the city Street lamps went out, the city was darkened to hide its landmarks, and search tights explored the skies for the raiders.

At one of the busiest street intersectrons, an officer halted all traffic. Private cars and buses were ordered to the curb. A trolley stood stalled on its tracks. Pobeemen hurried the passengers out of their vehicles and bundled them into doorways for she ter Buildings had been of deren to remain open all night for the purpose. Throngs also crowded into the but pedestrian tunnel between the Via Nazionale and the Via Teitone. The crowds had not long to wait before the bombers appeared. Concussions shook the air, Dummy incendiary and gas bombs were dropping from the planes—actually harmless, but exploding high above the buildings with realistic detonations. Thousands, peeking from their shelters, saw ambutances, dispatch riders, and fire engines rush through the cleared streets. Smoke pots had been set in public banktings at strategic points to similate real fires, and the firemen dutifully "extinguished" them. Stretcher bearers in gas masks picked up "gassed civilians" and carried them to the ambulances. The CITIZENS HELPED ARR RAID

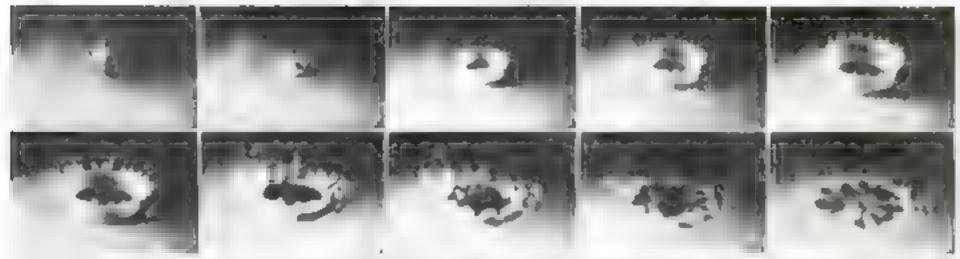
Drawing above suggests how frightened equidents of Rome ware herded one shell ters during above are ad. At taght firs man fight Hames' started by take bomb. Below extrems of suburb tear Rome drevsed and equipped to fight duting An per al attack that drupped dake gos bombs

alarms were repeated several times as

alarms were repeated several times as the arreraft passed over the city

No sooner had the airplanes withdrawn than crews were on the streets with chemical sprayers to clear away the last traces of the imaginary poison gas.

The object of the mimic raids was to train the populate in protecting themselves against an air attack. Also the goverament poteted out that the raids will make all citizens realize the horrors of war as fought with the deadly modern weapons. Rome, like many European centers, is making practical preparations for possible aerial invasion. Tunnels for a new electric railroad entering the city are being constructed with built-in shelters for refugees fleeing an air toid



With an exposure time of less than one bundted-thousandth of a second, these pictures of a falling drop of my k were made at the Manhachtohetta Institute of Technology. Note the crown shape, which becomes more marked as the drop strikes a hard surface. Pauri-like dropiets tip the clown points

Dazzling Spark takes Fastest Photos

HOTOGRAPHS at the rate of 4 000 a secand, with exposures ranging from 1 100 000 to 1 500 000 of a second bave been made at the Massachusetts Institute of Technology by means of an electrical circuit that produce light of great actinic intensity. The instantaneous flash is many times more brilliant

The misshapen figure of a golf ball in flight has

been recorded by means of this latest development in high speed photog-

The new carcuit, employing either mercury are lubes or spark gaps, was developed by Professor Harold E. Edgerton and Kenneth I Germeshausen of the electrical engineering department. By means of this circuit it is possible to make both still and motion pictures. For the latter, specal cameras are necessary.

The light produced by the new circuit occurs in pulses or flashes, and the intensity of each flash is equal to the concentrated light of approximately 40 000 ordinary fifty-walt bul is-beighter than the moonday sur. The scientific importance of the method lies in the fact that the frequency of the flashes or the moment of starting may be controlled.

FLAT GOLF BALL. Flash pictures, made an illustrated be ow with the impart of clab on ball compressing wires and closing directly show how ball flat tened when his, regains upherical shape

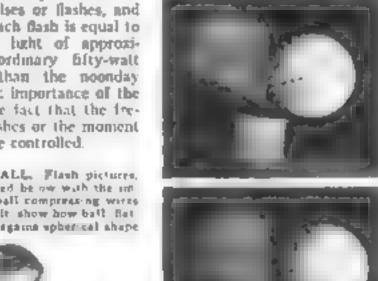
In making morion postures, the pulse of light is synchronized with the speed of the film waich moves past the lens aperture at velocities up to 200 miles an hour

The light has already been used to make photographs in which familiar things are shown in asterishing new forms. The splash of a drop of muck on a hard surface is revealed in the shape of a miniature crown tipped with infinitesimal pearl-

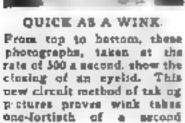
> like drops. Photographs of the human eye show that a wink occurs in approximately one-fortieth of a second Picture of golf club histing hall shows a most surprising dattening of the ball at the point of contact

> The chief feature of this circuit consists of mercury are tubes which are made to produce intense flashes of a blaish-white light









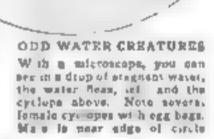
Big Game Hunting



OUR glass reveals queer creatures that live in a drop of water taken from a stagnant bond—Dense forests abpear in the green mold of stale bread and fungi wave their strange lace-like tendrils

DISSECTING MICROSCOPE

A tarrly powerful packet lenn in mounted as shown at the felt above a mirror that is not at exactly forty five degrees. The g sea taced top in held in place with finy no et er ben sbard this sab e that specimens ove d assected



Photomole ngengin Long Bend Logic Brantise a Supply Co.

VITTED out with the baggage I described last month, we are ready for our first journey into that strange world revealed by a microscope of reasonably high power

Our first sight-seeing tour leads us through a growth of fungus-a welfd forest that we will cultivate on a slice of

whose wheat bread

To graw this forest we simply place a piece of the bread in a damp spot in the celiar for a day or so. We shall soon find ne ka surface a delicate grecoish gray growth, one of the common molds, nalure a most delicate vegetation. By the careful use of our little scapel and needles mounted with handles (PSM, Dec. '32 p. 52), we separate a tiny speck of this material and place it on the surface of n glass saide. This we must do with patient fingers for we cannot afford to crush the delicate plants. Then, too, we must see to it that the specimen we take is so thin light will pass through it. A piece a little larger than a pin head will be plenty.

After it is placed on the stage of the microscope, we adjust the light until we secure an even field of illumination, not so bright that it will cause eye strain and not so dull that it will rob one of the view. Following the directions given last month, we then adjust the objective until it is about three-eighths to a half inch above the specimen and focus UPWARD. Presto! we enter the land of mold.

Mold is a common, unscientific name for fungi and what we goze at really is a microscopic form of mushrooms or toadstools. These tiny plants present themselves like great bushes of fine fuzz. We may find many other interesting examples of fungi on old cheese, plants, and the

On our next excursion, we come to the first great adventure for every embryomicroscopist: the examination of the life from a stagnant pool of water If we obtain the right kind of water, the fleeting afe that will sweep past our vision will make the traffic of a metropolis seem dull.

The professionals use special apparatus to collect aquatic life, but we can afford no such luxuries. So we take a widemouthed bottle or jur and attach to it a heavy piece of cord. A pust mayounaise par will be suitable. Stagnant pools of water can always be found near the city The bottle is dropped to the bottom of the pool and dragged across the soft moddy bottom. The experimenter should



THIS IS THE POREST PRIMEVAL Looking at the green mold on scale bread you will see a forest like this, with awaying tendrits

with a MICROSCOPE

BORDEN HALL

be sure to gather in some of the bottom mud for in it we shall find the most inter-

esting animals.

Naturally, in the examination of this welter of life, both vegetable and animal, we shall have to take things as they come for we are dealing with the tiny life of the sub-world. It will not be long, however, before we come upon those lively creatures, the water fleas, both male and female, although the latter will greatly putnumber the former. We proceed by taking a small sample of water from the jar with a medicine dropper and placing it drop or two upon a glass slide. This is brought to focus under the objective, leaving the tube of the microscope in a vertical position so the water will not man off and carry the specimens away

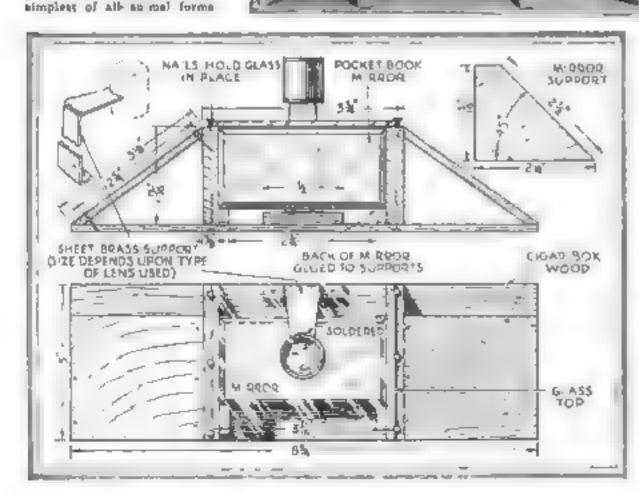
The water flea is recognized by its jerky method of swimming. It uses anything but the Australian crawl. We shall not need a powerful objective for this crustacean for, full grown, it is one-suncenth of an inch long. Indeed, nature has provided it with some pretty decent equipment.

If we watch closely we shall find that it has a head, a compound eye, feathery antennae, mandibles, and a tail. If our light is good, we shall be able to see the whole interior of the little flea, The beating beart will be visible as well as the digestive organs. If we are watchful, we will find a female with undeveloped eggs in

the back of her body Sooner or later, we shall come upon a creature named for the mythical giant, Cyclops. Here is another crustacean that

ambles ferkily through the watery lanea. He is a formidable appearing creature, with a single eye in the center of his flat head, a pear-shaped body, and a spike-like tail, Like the flea, he is provided with antennae, but he has





of life, a simplified edition of all living things. This is the amircha. It abounds in the mud and decaying vegetable matter at the bottom of pools and ponds. It measures about one-ninetieth of an inch but unfortunately we cannot describe an amora exactly The best we can do is to say that it is a tmy mass of protoplasm of no definite shape but capable of assuming

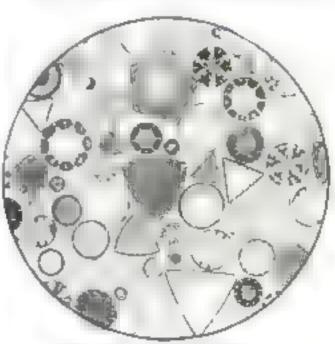
many different forms.

The ameeba has no organs, With its slimy little body, it can make projections that serve as bands or feet. When it is hungry, it wrops its whole body about its victim and absorbs it. It digests without a stomach, walks without hands or feet, and without a trace of a nervous system, it responds to stimuli. We shall indeed be fortunate if we can observe the birth of an amorba, the simple trick of a creature tearing itself in half to make two.

Interesting as the amorba is, we shall have to leave it to seek other wonders. For speed and prowess, we take our hats off to the polyacons, the playboys of pond hie. These tiny things, of which there are a number of varieties, live in colonies and are usually attached to the roots of aquatic plants. The polyps have strong family ties for they are found bound together with a nort of mucilage that nasumes a shape like the mouth of a wine glass while in the water

The little imps in this strange habitation are exceedingly beautiful and when actively feeding, we see them extending their delicate tentacles into the surrounding area with a lacy, wave-like motion. In so performing, they create a tiny vortex that draws their food into their mouths.

Then there are the rotifers, or "wheelbearers." We may find them swimming carelessly about or in their idle moments, attached to some sort of marine vegetation. We note the sucker-like foot, the transparent body, and the two disks at the head. Examining these disks, we discover where the creature gets its name for we see they are edged with fine lashes called cilia, which wave with such uniformily that one (Continued on page 54)



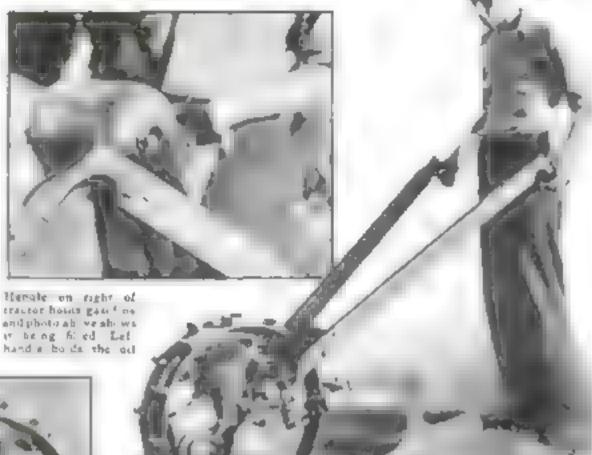
WHERE ARTISTS GET IDEAS Distores are tlay plants that are found, as picture shows, in many different flesigns

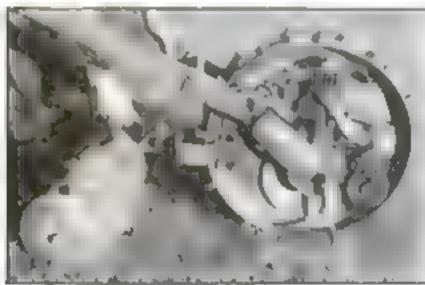
PIRST LIPE PORM. Your

glase will show ammbas, the

Homemade Tractor Has One Wheel

WITH a power plant that is suspended securety inside of a big ring-shaped wheel, a garden tractor has been built inrgely from odds and ends by R. D Read of Akron Ohio. It aperates like the unicycle automobile developed in England. (P.S.M. May, '32, p. 63.) A single-cylinder motorcycle engine was used without modification except for the installation of nn additional gear for cronking, and a planetary type clutch operated from the plow handle. The wheel is of sheet steel T-shaped lugs stud its outside surface to give the tractor a firm grip. Around the center of its inside surface is a steel ring of square cross-section, having steel pans running through it to form a tack in which the teeth of a straddle gear engage. This gear is driven by a chain from the planetary clatch. Each handle of the plowtractor is hollow, being made from chan-





Above tractor with engine ine do in one wheel has p ow at ached and photo a left above the tra tot put he e deak hers ow. The ma hims. made of odds and ends w I run for more than eight house to one Englos of Esse int

re, tron stock. One handle carries gasoline and the other oil. Controls are near each handle grap. To a coupling at the rear practically any farm tool can be attached. The tractor with a four horsepower motor, will run for eight bours, as fast as a man can walk, on a gallon of gasoline

TREE-LIKE CHIMNEY ON STONE HOUSE

REAR VIEW MIRROR AND AUTO CLOCK COMBINED

CLUCK and rear view marror are combaned in a new accessory for motorists A few pulls of a small cable beneath the timepiece wind it. Thus a draver can wind It without slackening speed or taking his eyes off the road

PAPER SHEETS FOLDED TO DRY RAZOR BLADE

SAFETY rasor blades can be dried and cleaned without taking the razor apart by means of paper driers recently put on the market in France. The absorbent papers are cut and folded so they alip over the blades between the loosened guards and can be moved back and forth to dry the blade. The divers come in small booksets from which the sheets are easily tom.



into a house being built by Mrs F. E. Routledge of 5an Antonio

Folded paper theets used to dry raser



House built of many kinds of sions at San Antonio, Texas bas tree us th mucy with several branches, through each one of which the smoke satily escapes

ELECTRIC SAW BURNS THROUGH STEEL BAR

REVOLVING rapidly, a new electric saw will burn its way through ten inches of solid steel. Its cutting tool is a smooth disk made of special heat treated steel, rotated hy an electric motor. The bar to be cut as clamped in a movable vise and one side of the accordary of a special transformer is connected to it. The other terminal of the transformer connects to the rotating disk. When the bar is moved against the lisk, an electric are melts away the bar.

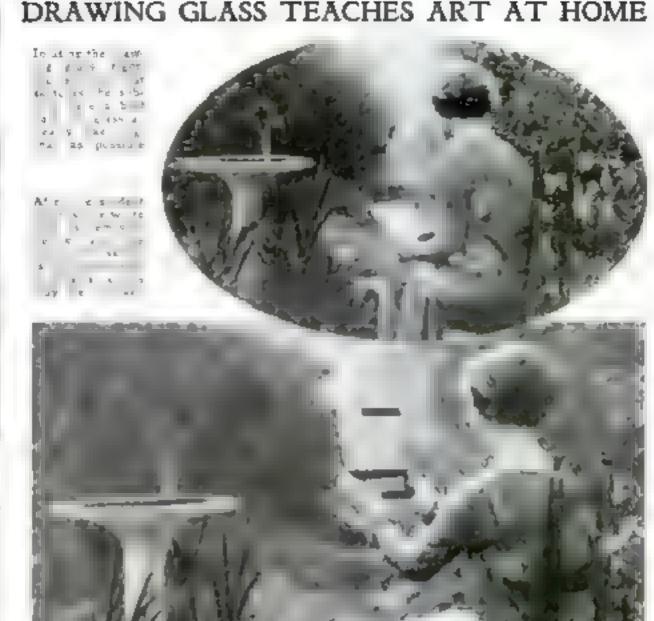
KEY RING ON SPRING REEL

To keep keys handy, a new spring reel for a man s be t has been designed The reel unwinds when a key is pulled out for use. as Illustrated. When released, the spring snaps the keys back into place.



A NEW vision training device called a "drawing glass" quickly teaches children or other beginners to draw and paint, according to Anson K. Cross, art instructor of Boothbay Harbor, Maine, who perfected it. The drawing glass consists of a common window pane, backed with a removable white card, set in a frame with a spirit level. The student first tries sketching an object from nature upon the backed glass, using special crayons, Glancing from subject to sketch, he corrects the latter until he thinks it perfect. Then he removes the card and sights through the transpar-

sketch until the outlines match. Errors are revealed at a glonce. The sketch is crased and other attempts made, up i. repeated practice gives the student mastery at judging form. Two lenses in the base of the device trum his color perception by blurring details of the picture and enabling large masses of color to be recogmaed. The inventor says that an amateur using the drawing glass in his home soon acquires a proficiency that would customarily require personal instruction from expert teachers, followed by a long period of training and patient practice by even the most tarented students



ent sketch at the subject, moving the

WORLD'S SMALLEST COAL MINE OPERATED BY SIX MEN entrance to they coal make in Rhur district of Garmany, & 2. erversions to the transfer of the contract of A p 2 nel sise a 1 11 1 1 1 1 Thre.

With an abandoned streetcar for its office, what is said to be the smallest coal mine in the world in operating at a profit in the Rhur district of Germany, It was started four and a half years ago by six tmempioyed miners. An ancient locomotive, two tiny cars, a second-hand air compressor a windlass, and a winch was their en ire equipment in attacking the vein of coal which was so small that

and ever thed to commercialise it. members of the company work and. Two handle the coal at the while the sixth attends to selling ang the product. The vest pocket reported a small profit for each of the years it has been worked.

Three-Wheeled Auto Looks Like An Airplane



WITH wings for fenders and a stream, med metal body that resemries an airplane fuselage a three-wheeled, frontdrive automobile recenty underwent tests at Indianapous, Ind The auto-pune, said to be capable of seventy-milean-hour speeds along a highway, is the invention of Grover E. Olds, an aviator Steered by the "caster" wheel at the rear, the fifteen-foot-long machine can turn in a racius of fourteen feet A four-cylinder, sevenbersepower motor within the body turns the front wheels, The two passengers sit in cockpits

Priors of light airplanes may now taxi up to a row of gasoline pumps, choose their favorite brand, and tell the attendant to "fill 'er up." The picture below shows

opened near a Berlin, Germany, air field. A featherweight craft of the powered glider type is fueling up. A good-used funnel insures that the gas will go where it is wanted without spilling



ELECTRIC CUTTING TORCH CAN VAPORIZE DIAMONDS

Hot enough to vaporize diamonds or to melt tangaten in the arc of a new electric cutting and welling torch, designed by a Los Angeles, (al. it. engineer. Two electrones in a special mounting enable it to form its own arc, independently of the material to which it is applied, as shown in the photograph above. The temperature attained is about 6,500 degrees F



FILLING STATION OPENED FOR PLANES

Light sport sincraft taking on gas at filling stay on for planes near Berlin .

MATCH CAN BE LIGHTED 100 TIMES

If y it berrow a match from the gentleman pictured at the right, he is likely to want it back. He is one of the users of a new repeating match recently produced in England. The match may be struck and relighted more than a hundred t mes. A small box, coated with a special composition used as the striking surface, serves as a holder for the repeating match when it is not in use. The device is much thicker than an orginary patior match and gives a correspondingly larger flame.



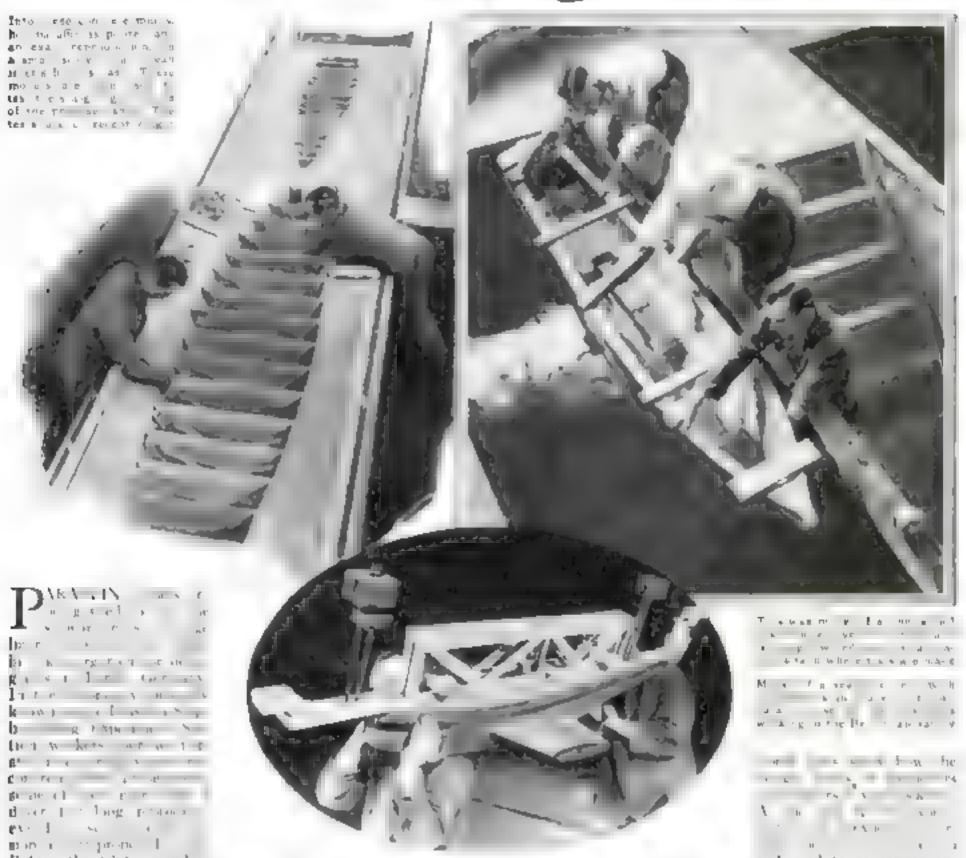
BURNED OUT BULB GLOWS

WHEN a string of miniature low-voltage lamps of a new type for Christman tree and ornamental use goes out, a telltale glow appears in the one that caused the trouble. A burnout impresses full voltage across the lamp termi-



nais, causing a small quantity of neon gas in the bulb to glow. This is visible through a window of clear glass near the base of the bulb

Wax Models Test Big Ocean Liners



Before the white wax-like models are placed in the testing tanks, bry they are given a number and gone over with a special apparatus that seals all leaks. Then the tests begin. Cameras snap pictures, an omatic instruments record tion

da.a. experts jot down notes as the em-

bryo liners buck six-inch waves and artificial winds on the water of the testing tank

The results furnish valuable aformation about the characteristics of a liner months before even he keel is laid. Addiand used to reproduce another greyhound of the sea. Besides the work in testing adup designs, the experts at his laboratory are using paraffin models in an extensive investigation of the charac existics of various types of German scapane floats and Cying tout hulls

BIRD-EATING SPIDER CAPTURED FOR NEW YORK ZOO



A RUGE black spider, whose outstretched legs and harry body would cover half thus page, was added recently to the collection in the reptile house of the New York Zoological Park, New York City, It was named Black Beauty by its captor, Raymond L. Ditmars, curator of reptiles and mammals. It is a relative of the tarantule and is known as the bird spader in its native Central and Sou h American countries because it often captures and devours small birds. It lives in holes and under logs, spins no webs, and hunts only at night Sometimes, the hair-covered bodies of these giant arachmids are said to measure seven inches in length with legs pearly as long

Home Chemists Can Make These Interesting



HEN you stir your morning collecto dissolve the sugar, you are demonstrating an important property of solutions. Like all soluble substances, augar dissolves more readily when each tiny particle is brought into direct contact with the figuid. Stirring does this by agitating the sugar and spreading it throughout the collect.

Surring, however, is only one means of making a substance dissolve more readily. Temperature also has a great deal to do with solubility. Hot collee, for instance, will dissolve sugar faster than cold coffee On the other hand, substances such as gypsum (calcium sulphate) and slaked has (calcium hydroxide) dissolve more readily in cold water than they do in hot

In many cases, beat is given off when certain substances are dissolved. Amsteur themists will recall the warning regarding the formation of heat when sulphurse acid and water are mixed. To be rafe, the acid should always be poured into the water and the musture stirred continuously to dissipate the heat. If the water is poured into the acid, it does not mix but floats on the acid and the heat formed where the two liquids meet will often generate enough steam to blow the water and some of the acid out of the container Lime (calcium exide) and ive (sodium hvdroxide) also produce heat when they are dissolved in water

Of course, many substances can be dis-

solved wathout affecting the temperature of the solution white others absorb heat when they are mixed with water Saltpeter (potassium nitrate), hypo (sodium throsulphate) ammonium nitrate, and many other chemicals cause a marked drop in the temperature of water when they are dissolved. The home chemist can perform a striking experiment to show this action with n beaker of water a block of wood, and a bandful of ammonium nitrate

Pour some water on the center of the wood block and set the heaker of water in the puddle that is formed. Then pour the ammonium nitrate into the beaker and stir it vigorously to dissolve all of the chemical. In a minute or so, the pool of water will be frozen so solidly that the

wood block will stick fast to the bottom of the beaker. This absorbing of heat by certain dissolved chemicals was used centuries ago for cooling wines and foodstuffs.

The ammonium nitrate solution can then be set aside. As the water evaporates, the solid ammonium nitrate will crystallize out and can be used over and over again.

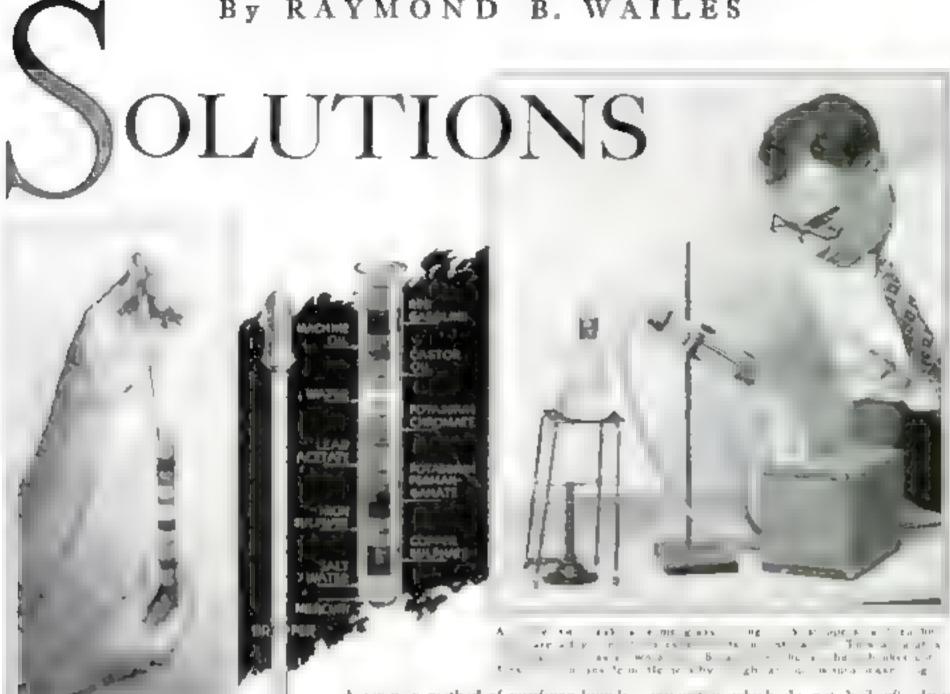
W QES

Pictures above show how support for beaker is made of best curtain rods. At right simple water both consisting of beaker of water placed over Bunson Same. Shallow dish on top of beaker contains solution to be evaporated.

By means of the simple evaporating artangement shown at lower right on this page, the amateur can hasten the evaporation and obtain the solid ammonium intrate quickly

The apparatus used is called a water bath. It consists of a braker of water placed over a Bunsen flame and is similar to the double boiler used by the housewife

By RAYMOND B. WAILES



I unreat on and diagram above show how to make a Jacob a tube. A song dropper with a cultiur butto to used in placing togred ento in the tube on they will not use

when cooking outmeal. The solution to be evaporated is placed in a shallow dish which rests on the open top of the beaker, bubstances crystal ized out from solutions made from distilled water prove to be purer than before being dissolved

ANOTHER method of purifying cer-tain substances is called sublimation. This process can be demonstrated with moth bails or much flakes (napthalene) Crush the balts or flakes and place them in a shallow iin cap taken from an empty can of baking powder. Put an alcohol burner or other small flame under the improvised dish and heat slowly. Soon, you will notice a heavy vapor rising from the powder This vapor consists of small particles of napthalene. If a cool body, such us a glass or flask folled with cold water, is held above the dish, this vapor will subarne on the chilled surface in the form of beaut ful, flaky crystals of pure napthalene. These shiny crystals will grow to a quarter of an mch in length if the process is continued. The crystalline formarion will not be permanent, however, as the napthalene will vaporize in the air Just as moth balls disappear or become smaller when they are packed away in a closet or chest for any length of time, so the napthalene crystals will vanish.

A common method of purifying liquids is known as distillation. As applied to from the condenser into the receiving water, distillation forms a practical as beaker as shown in illustration above well as interesting experiment for the amateur chemist. Distilled water, free of impurities, is a useful article to have arount the home laboratory

A simple distillation apparatus can be made from an olive bottle, some glass luborg, two cork stoppers, and a rubber tube. The liquid to be distilled in placed m the distilling flask which can be supported on an improved stand made from discarded tubular curtain rods. The flask should rest on a square of from fly screening large enough to cover the stand

The olive bottle with its bottom removed forms the water jacket for the condenser tube leading from the distilling tlask. Two shorter tubes, one placed in each stopper, form the inlet and outlet for the circulating water which flows in the jacket. The inside of the long condenser tube should be not less than onequarter of an inch in diameter

TO OBTAIN perfect cooling of the condenser tube, the circulating water should enter the jacket at the lower end and leave at the upper end. In this way the water next to the hottest part of the condenser will be immediately withdrawn and replaced by cooler water

To distill water, place it in the distilling flask and beat it with a Bunsen flame. As the water boils, steam will be generated and this will flow out of the flask into the cooled condensing tube. When the steam strikes the cold surface of this tube it is condensed and pure water, minus the

impurites which do not boil off drive

If he running water is available for the condenser jacket, a sustable supply can be had by rigging a syphon from a large jug of water placed high above the table.

If LEAKS should develop in the corks at each end of the condenser jacket, they can be stopped by applying shellad to the cracks

By fitting the distribing flask with a separatory funnel, like the one described in a recent issue (P.S.M., June '32, p. 64), the supply of water can be continually replenished without stopping the process

To demonstrate the purifying action of distillation, the home chemist can piace a strong water solution of salt in the distilling flosk. The final distillate, which drips from the condenser tube, will have no trace of a salty taste. A simple apparatus of this type is often carried by aviators when they attempt a flight across the 'ocean. Should they be forced down, drinking water can be made by distilling sea water

If a blue solution of copper sulphate is placed in the distilling flask, the distillate will be pure, colorless water In both of these experiments the impurities in the water and the original substance dissolved remain in the flask.

We have seen by various experiments illustrating diffusion that such substances as sugar and copper sulphate when dropped in water sink down and slowly dissolve to form a strong (Continued on page 82)

New Conveniences

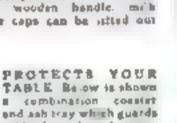


ELECTRIC MIXER AND CAN OPENER Driven by a small motor this new hitchen users a which to haid to cause no radio interference, cumb are a meat chopper, tan opener and also a build sharpener



MILK BOTTLE CAPA With a speer pointed rad, lattered to a wooden bandle, milk bottle caps can be sitted out

table from bound status





REPRICEMATOR PREEZES ICE CREAM. The freeze two views of which a c shown be ow is fixed with ensurer and placed to tell gerator. As it begins to freeze, handle is pushed in and not to mix contents. Pictures show freezer to use and also with top removed.



LODENS ICE TRAY Tipped with rubber, this tool is apacially designed for the in pryog out les trays. Handle showed forward against abank pare the tray toose

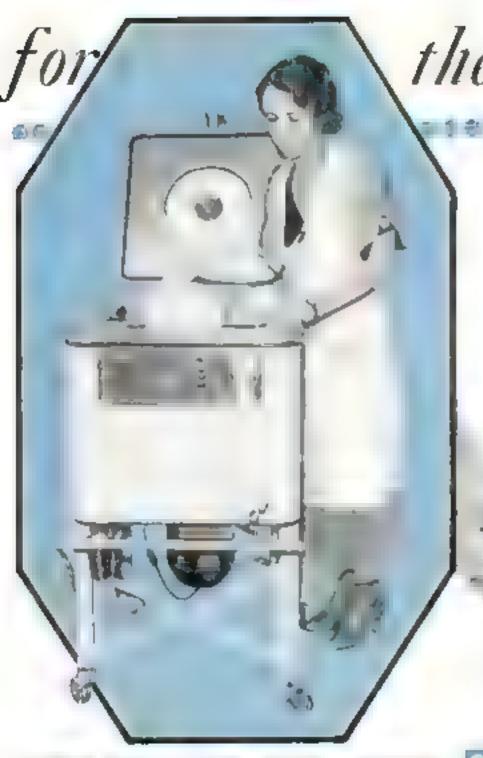


BUTTON ON SALT SHAKER.
Ball flows from this abover when a white button is pressed and perpeter comes at pressure on a black button. Movable cork breaks up that lumps so they wall flow easily



THIMBLE HOLDS WREDLE.
Those who see will appreciate this comb has on the tobe and needle hulder. It is especially useful when work is being done on heavy material shrough which it is hard to pass the needle without lotting it slip.

KEEPS THE PLATES WARM In addition to drawers in which are stored pots and pans and other k tehen utensils, the new range shows at left, has a plate warming temperature that can be turned on without interfering with the other things that may be cooking at the time



the HOME .

PLRHER COVERS
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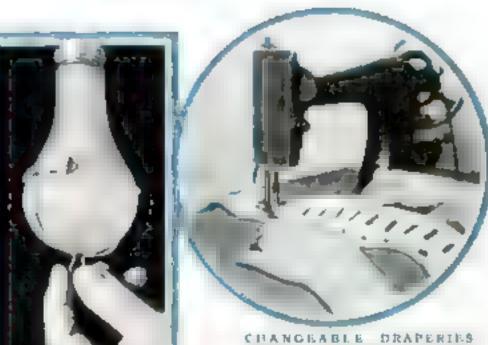
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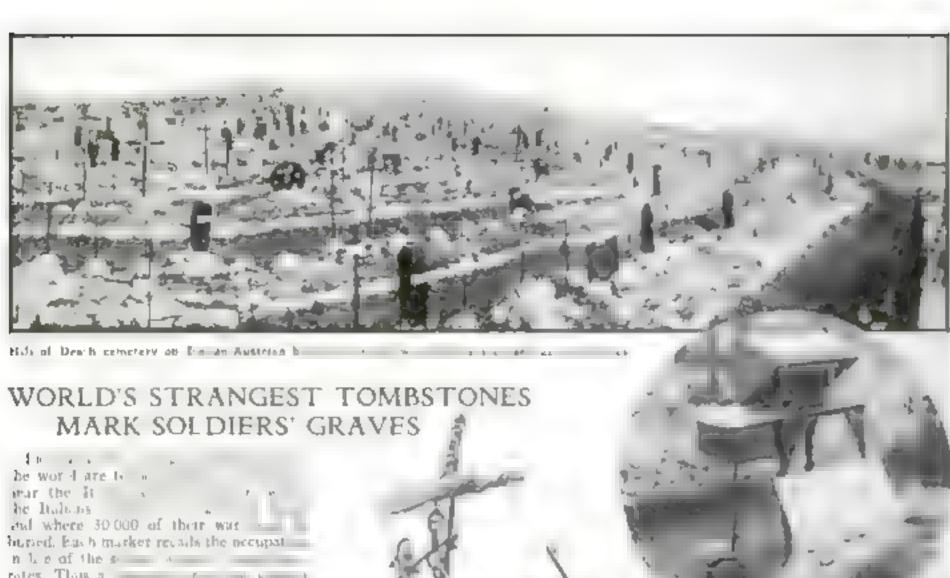
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CHANGEABLE DRAPERIES

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rates. Thus a s ands over the control to A productivity of over the tomb of the am whole operating it. I come a memory n tribute to an A mio in atta care signing. A probably the first t ry, marke the laver is worker in to a tor erlo ar c or am Ing proceed of a constraint action on the second

FLASHLIGHT OF MANY USES HAS NO BATTERY

out batteries have appeared to fore, but a new model has be placed on the market with of attachments that give it uusual versatuity. In a few onds it may be transformed from a hum. fushlight into a "candle camp for compers. So that it may be stood on a table to furnish light as shown in the photograph. An extension cord may be plugged in to give a convenient light for exnminution of the threat by a physician or home nurse. Special lenses also ampt the flashight for use lographer's darkroom, Two stlamps are held by spring clips back of the reflector. There are no l ies to be replaced, since an efficienlittle dynamo within the case supplies current for the bulb. A few turns the handle would a spring inc. . . . furnishes sufficient power to a set the dynamo for several minuteing which time the bulb throws our a aght as strong as that from any battery flashlight.



Placklight, tun by dynamu, can be used as candle lamp and has cord and bolk for threat examinations

PRACTICE BRIDGE HANDS DEALT WITH NEW SET

PREPARED contract bridge hands, for practice and study, may be dealt with a new set consisting of a special pack of cards and a metal chart. The backs of the cards are marked with black dots in different patterns according to the suit and denomination. When the cards are injerter one by une in the chart, as in the photo, the dots show through boles in the chart and arrows indicate to which player each card should gu



POPULAR SCIENCE MONTHLY



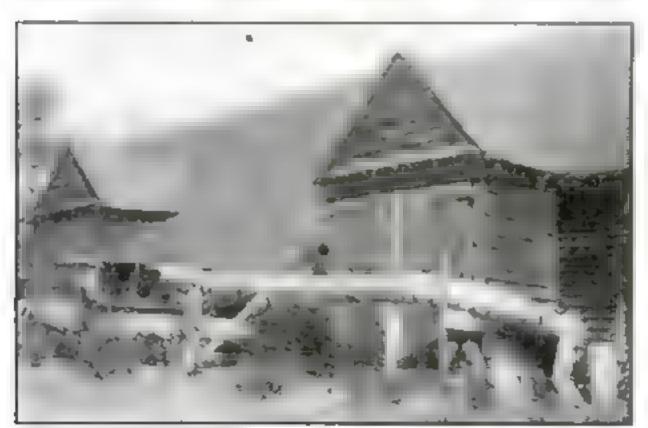
HOT AIR KILLS DEATH WATCH BEETLES

Strendented air in England's latest weapon against the ravages of the "death was to begans to be tacking sound made by the curious insect is though, by superstitudes persons to be an omen of death. Actuary its unwelcome activities take a more practical form. The grades attack the wooden beams of uncient structures and reduce them to crumbaing shells. Such historic buildings as Westminster Hall and

Checquers, the official residence of the Prime Minister, have been riddled by the pest. When it recently attacked a famous old barn near Beaconsfield, which is supposed to have supplied the timbers for the Pi grim vessel Mayfower, strenuous eradicating methods were called into play Huge pipes have been rigged up leading thio the barn, and extremely hot air is being forced from them to kill the beetles

VISSEL ACKINGT PONTOONS

HEEP HOLINE YOUT



Bern near Beaconsfield, England, that supplied the timbers for the famous ship, Mayflower, is being saved from ravages of death watch beerles with hot air pumped into it through big pipes



ing it an ultra-modern war weapon with a

wile attacking range

GAGE HELPS GOLFER FIT CLUBS TO HIS STANCE

A "measuring club," invented by a Manchester, England, golfer, belps players in selecting golf clubs stated to their stance. While all players require clubs of such shape that the sole lies flat on the ground, variations among individuals in length of arms and legs make it impossible for all to use an identical design. A prospective purchaser may therefore be bitted with the aid of the measuring club. When its movable head is adjusted to stat the player, an indicator on a scale shows the angle of the head to the ground that will be most satisfactory for him.

Easy Tests of Strange Facts

MAKE YOUR OWN MICROSCOPE. In piece of tin punch a hole with a large needle. Then melt some Canada below, which you can get at any drug store, and place a single drup of it on the hole, being careful to see that it does not run. When the beloam hardens you will have a microscope more powerful than one with a glass least



A METAL CRICKET. Hemmir a qualidish of metal, the preferred, here a bollow dish shape. With a pair of pilers, bold the disk over an elected flame. As the metal gets bot, a point will be reached at which the disk will suddenly turn itself inside out with a loud stick. Discovery of the action had to all the flattern and made one man rich

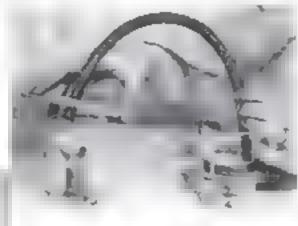


HOMEMADE microscope of Canada balsam reveals hidden wonders, . . Simple apparatus needed to produce singing wire. . . How your breath can print picture on h tiny bit of hot copper

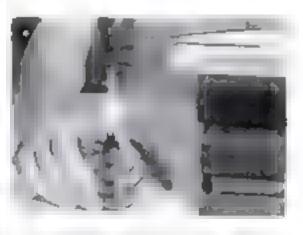


MOVING A WEIGHT WITHOUT TOUCHING IT

Table to have replayed to a first and the case of an end of the case of the ca



A CAMPLE PUMP In this gross, left above, a small amount of water is praced and in this is set a righted candle. Put land around the top of the glass and iny over it a piece of cardboard through which a rubber hose passes. The other and of the hose is placed in the glass at right. Water will pass from grass at right to one at reft



MEASURING SPHED OF HEAT, You can prove that different motes a conduct heat at different opened by this simple experiment. Take a piece of copper with a cake of paraffer as literated above. Beneath the wire under place an alcohol, flams. The paraffer under the copper make first as heat moves fester through copper than son



THIS WIRE WILL SING.

Cut a bole through a terk and insert a med cine dropper. Then make a loop of fine wire, at the loop is across the small end of the dropper. Attach a piece of rubber tube to the large and of the dropper. If you hald the davice in a draft of air and place the tube to your ear, you will hear music.

MAKING A DINE JUMP.

Place oil around the mouth of a bottle and over this lay a dime so that the bottle is hermatically scaled. If you then were your hands and hold them around the bottle, as illustrated at the right, their heat will warm the air in the bottle and this, expanding will make dime jump off bottle



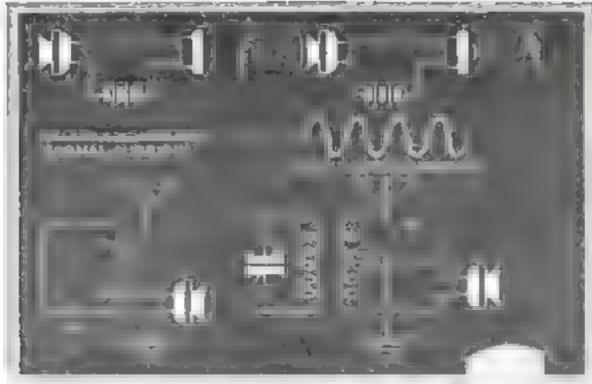


A PICTURE ON METAL

Polish a piece of sheet copper and on it piace a a liver coin. Hold the copper over a flame as illustrated until both copper and coin become thoroughly heated. Then remove them from the flame and perm t them to cool off all ghtly. If you then disladge the coin and hreathe upon the spot where it lay, a sharp outline of it will appear

HEAT ENDS MAGNETISM

The experiment illustrated at left has interesting possibilities. Artach a needle to a amali wire and set it swing against a horseshoe magnet beneath which is an alcohol fame. As the needle becomes hot, it will fall away from the magnet but as it cools it will exturn to its original position



Drawing, left, shows how current in hattery operated telephone circuit in modulated by sound wave suriking disphragm of microphone. A and B show way of connecting macrophone, Below good carbon in crophone



JOHN CARR tells

How You Can

Talk Over Radio Transmitter

Since the same of the same of

The basis of radio telephone operation is the process of modulation and most common of all modulating systems is the battery-operated land telephone circuit consisting of a simple carbon microphone

a battery, and an earphone

In a sense, the carbon microphone is a variable resistance controlled by the sound waves striking its flexible metal diaphragm. Small granules of carbon, held in a metal shell in back of the diaphragm become more or less tightly packed depending on the pressure of the sound waves against the diaphragm. When they are pressed tightly together, the resistance of the microphone is decreased, when they are allowed to spread apart, the resistance is increased.

When no sound waves enter the mouthpiece, the resistance of the interophone is constant and the current flowing in the circuit is also constant. When sound waves strike the microphone, its resistance is altered and the current flowing in the circuit varies accordingly. At the earphone, this varying current is converted back into sound waves by the action of the electromagnet on a thin metal dia phragm. The process of superimposing the sound waves on the normal current flowing in the circuit is called modulation and the current is said to have been modulated

To compare this simple system with a radio telephone, it is necessary only to replace the battery with a generator of continuous waves and to substitute a radio receiver for the earphone

In a radio receiver, the radio-frequency current in the circuit conforms with the current in the transmitting antenna. In other words, any variation in the antenna current at the transmitter is faithfully reproduced at the receiver. Changing the antenna current of a continuous wave transmitter according to sound vabrations is basis of radio telephone insidulation.

NORMAL CARRIER PLATE VOLTAGE MODULATION

ANTIENNA
CURRENT

AUTHO-FREQUENCY MODULATION

Diagram of grid-bias and place voltage methods of modulation and antenna correct changes

One of the simplest ways to vary the antenna current according to sound waves is to connect a sample carbon microphone of the telephone type into the antenna circuit of the transmitter as shown at A is the drawings. Any changes in the resistance of the microphone, caused by sound waves, will then cause corresponding changes in the antenna current. Although such an elementary system is not practical where quality is desired, a microphone can be connected in this manner provided it is of the proper normal resistance.

Another simple way to very the antenna current according to sound waves it to connect the carbon interophone as shown at B. In this case, the microphone is not connected directly into the antenna circuit but is placed in neries with a few loops of insulated wice that are closely coupled to the antenna inductance. When sound waves strike the microphone the resistance of the loop circuit is varied accordingly and more or less chergy is absorbed from the antenna.

Hecause both of these methods absorb energy from the system, they are called "absorption methods of modulation" With both systems, the quality is poor

and the efficiency is low.

Obviously, a better way to obtain modulation would be to vary the generated voltage. This could be done by varying the filament voltage, the grid-bias voltage, or the plate voltage. Of these, the gridbias and plate voltage methods form the basis for common systems of modulation used in radio telephones.

In both the grid-bias and plate voltage circuits, the mi- (Continued on page 95)

Making Car's Radio



RECEIVER in Auto Must Be
Built and Installed so It
Can Stand Road Shocks
and Vibrations—Interference Due to Spark Plugs
Can Be Reduced with the
Right Use of Suppressors

By GEORGE H. WALTZ, JR.

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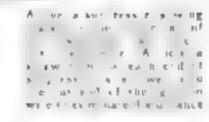
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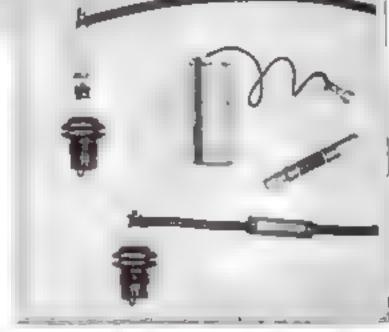
Bren ise as a point a general one he he he he had a subject to the he had a subject to the head of the head had a some subject to the head of the head

the the home train as reader to when the speed of some values of the formal speed of some values of the speed of the

Since their heaters are a say of to operate efficiently from a six-volt automobile battery without a rheustal or fixed resistor, the type '36, '37, and '38 tubes are recommended for automobile use. These

45 - 6 - 6 - 6 - 6 - 6 n Lynke E " ag the harang haran y same to c r o r pe the A 100 CO (100 CO) te to aphal n night tamper in it z by spilled and in the room of be it are fare by to or quarter by post time m2 350 Bit 1 to 15 to to the same of the state of the party of the and the property of the same iv free from the metal work of the body and frame, the root type of antenna is undoubtedly the best you can procure.





Here are two types of suppressors used in ears. One at top is attached to plug and below it, one placed in spark plug wire. In center, condenser for generator

Give Best Results .

While the amateur mechanic can install a built-in antenna of this type by using regular copper wire mesh, (about No. 16 is satisfactory) the removing and replacing of the mof kining material proves a difficult job even for the experienced upholsterer. Special auxiliary antennas, now available, provide a simple solution to the

problem

One commercial type of antenna, for roof installation, resembles a modernistic panel when fastened in place under the roof of a car. Being covered with a material to match the upholstery, the antenna panel blends with the background and forms a part of the interior. For best results, the panel should be placed at about the center of the roof Of course, the best position will vary according to the placing of the dome lights. These antenna units can be obtained in various sizes and with coverings of different color to match the make, model and upholstery of the car

Other auxiliary antennas are made for ase under the car. These can be obtained for installation under one or both running searcs or under the frame of the car. The running board type illustrated on this page is a snugly under the running board where it is hidden from view and protected from layary. The other type is equipped with four substantial canvas straps so that it can be suspended between the front and rear axies. All these auxiliary antennas are sold complete with lead-in wires.

OF COURSE, the amateur can also install a simple antenna by tacking wire zig-zag fashion, to the underside of the roof. In most cases, this type is inefficient

In an automobile, no actual connection with the ground is possible so that the whole frame of the car is used in the manner of a counterpoise performing the same function as a ground but not thing

troubes are present dense to a principle source of trouble with the high tension without the high tension without the four till eight the light of the four till eight twelve, or the four till eight to a sk at the

RUNNING BOARD ANTENNA

Be ow and at right two views of

the anter a large of kind of be

a set of he sea hard of an eg bead

A B C's OF RADIO

RADIO waves can be specified in wave length or frequency. As the names imply, wave length is the length of each wave and the frequency is a measure of quantity in terms of the number of waves that pass a point in one second. For consistency, wave lengths are measured in meters and frequency in kilocycles. Since radio waves travel about 300,000 kolometers a second it is a simple matter to figure either value if the other is given. Dividing 300,-000 by the wave length gives the frequency in kilocycles and dividing 300,000 by the frequency gives the wave length in meters.

plug induces high-frequency oscillations in the high tension waring and these are radiated to the receiver

To suppress these oscillations, 25,000ohm resistors are placed in each spark plug lead and in the high tension lead to the center tap on the distributor cap. Resistors designed for this purpose are called suppressors and can be obtained in complete sets from dealers in radio parts and supplies. To be most effective, these resistors should be placed as close to the source of trouble as possible—directly at each spork plug and at the distributor cap.

Of course, on some makes of cars it may be impossible to place suppressors directly at the spark plugs. If this is the

case, similar resistors can be placed directly in the spork plags leads as shown on the preceding page or they can be placed at the distributor cap

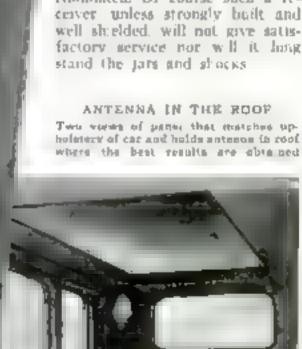
Sparking at the brushes of the generator is also a source of troublesome interference. To overcome this, a one- or twomicrofarad condenser is connected to the frame (ground), from the wire that delivers power from the generator. Interference originating at the low tension breaker arm can be partially eliminated by connecting a condenser across from the supply lead on the coil to the frame.

WHEN receivers, as in most cases are mounted under the instrument board, precautions must be taken to prevent any interference from wiring, ammeter, and ignition lock. For instance, it may be found necessary to supply a better ground for the steering column and such controls as the choke and spark rods. Similarly, the wires leading to the ammeter should be twisted together for a large portion of their length to neutralise any magnetic effect formed by the voltage fluctuations in the wires. If the ignition coil is mounted on the cowl panel opposite the receiver, it may be necessary to shield it.

Authlury electrical equipment, such as electric windshield wipers, cigar lighters, electric gasoline gages, or fans, is often found to be a source of annoyance. A condenser, connected across the particular lead in question to the ground, will generally chiminate this form of interference.

To test an installed radio receiver for total interference, adjust the receiver so that it is operating but not tuned to a station. Interference noises can then be heard in the loudspeaker. For best results, interference tests should be made along a country road where other external interference is generally reduced to a test truty

Many remers may worder if their hance sees can be used at a receiver will work in an auto provided the unwanted nones are eliminated. Of course such a receiver unless strongly built and well shielded, will not give satisfactory service nor will it long stand the tark and shocks.



How to Logate Motor Knocks

Gus Explains the Meaning of All the Strange Noises That Come from Your Car's Insides

paper and glanced out of the living room window just as his next door neighbors, the Bensons, returned from their weekly tussle with Sunday afternoon traffic

Dan seems to be taking it slower than usual," thought Gus as the car passed at a snall's pace and came to a stop outside the Benson's house. "The missus must be back seat driving. Fifteen miles as bour isn't that lad's speed."

When his wife, four children, and pet dog were safely inside the house. Dan Benson climbed the steps to Gus's porch and held a finger impatiently and insistently on the door bell button

"Sorry to bother you. Gus, especially on your day off," Benson apologised when Gus opened the door, "but somethings wrong with that car of mine and I in scared to drive it as far as my garage. On the way home, it acted like the engine was falling apart. All of a suriden the steering wheel began to wohle, and the further I drave the worse it got. Every time I d start up in traffic, the whole car would shake and the motor sounded like the anvil chorus

So that's why you drove by as though you were going to a funeral Gus chuckled as he took down his hat and cost

When they reached Benson's car Gus shd into the driver's seat and morioned Dan to sit beside him "Let's take a ride ground the block." he suggested as he pressed the starter

Doesn't sound so bad when it's offing," muttered Gus as be leaned forward to get his ear nearer the motor

"It seems to run fine at high speed too."

Gus shifted into low gear and cautiously released the clutch pedal. The whole car began to vibrate as the motor grouned and the car jerked unsteadily ahead. Gus again tilted his head and listened.

"I don't think it's your motor," he bellowed over the clatter. "It must be your clutch or drive shaft. Let's go down to the garage so I can run it up on the greas-



You we sure been riding with Lady Luck and didn't know it? Gue and as he looked up at the underside of the car. "The front end of your draws shall se ready to come loose."

ing rack and give it the once over from underneath. Joe Clark, my partner, is down there trying to catch up on the impaid bills. He'll be glad to see us."

Wasting little time, Gus soon had the car raised on the tack and was bustly rolling up the sleeves of his Sunday shirt

"Holy smokes," he grunted as he glanced up at the underside of the car, "You've sure been riding with Lady Luck and didn't know it."

By MARTIN BUNN

Joe Clark and Benson looked in the threetson he indicated.

"The front end of your drive shaft's just about ready to come loose. That connection between the transmission and the front universal should have six bolts building it together. Four have dropped out and the two that are left are on the same side of the flange and about ready to drop out too. If that drive shaft had dropped when you were going fast, the front end would have dug into the road sure as shooting and tifted the rear of your tar into a front somersault."

"But, Gus," Benson asked humbty when the gray-baired mechanic had replaced the missing bolts, "what made all the noise? I could have sworn it was in the motor."

Being loose, the connection buckled every time you gave it the gun
You see," Gus explained, using his
bands to demonstrate, "the universal
was connected to the transmission
shaft only at one point where the
two loose bolts were. Naturally
there was a lot of play and every
time your motor pulled, the two
connecting flanges twisted and hit
against the two loose bolts. Being
connected off center, the shaft vibrated and the whole car raitled
as though falling apart."

"It certainly sounded as if a main bearing was falling to pieces, Benson insisted.

"That's the trouble with most car owners," Gus said jokingly as he wiped his large, greasy hands on a convenient piece of waste. "Every time you bear a rattle or a he se you think it s in the bearings. Nine times out of ten, it isn't.

Motor knocks generally occur in cycles. The majority of knocks people hear are nothing but valve noises. You've got a valve tap in that motor of yours, but I wouldn't advise tightening the tappets, because tight tappets wear faster.

Most times, a motor knock comes from nothing more than carbon, advanced spark, or a poorly adjusted carboretor. It's best to look for the common troubles before you blame the bearings or pistons. I've had people come in bere with great tales about bearing knocks and lots of them have turned out to be noises caused by loose motor fittings or bolts."

But how can you tell one knock from the other?" asked (Continued on page 91)

GUS says: You can't carry in your tool kit all the special tools a mechanic uses but you can select your tools with care and foresight. A good set of spanner wrenches, a socket wrench, stiff wire, cotter puts, and tape make excellent additions to your repair equipment.

BETTER SHOP METHODS: IDEAS FOR THE HANDY MAN: BLUEPRINTS



MODEL MAKING : HOME WORKSHOP CHEMISTRY: THE SHIPSHAPE HOME



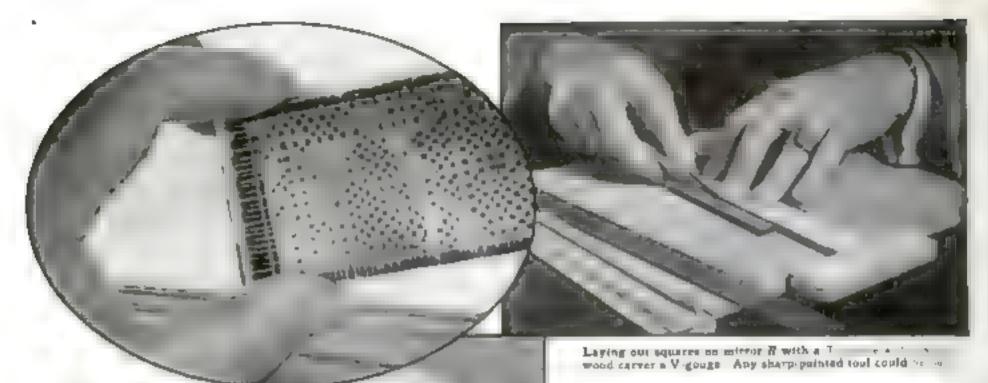
Make It Possible for You to Draw Anything Accurately - Models, Objects, Landscapes, Portraits, or Copies of Plans and Photographs

RAWING is the language of the mechanic. Whenever you set out to make anything more complicated than a shelf or a box, it is necessary either to sketch your own design or to use some other designer's mechanical drawings—drawings such as those illustrating so many of the articles in this department. In either case the information is given by means of lines and dimensions, not words. This explains why it is that every mechanic, whether amateur or professional, takes a keen interest in drawing, and why many of them are either similful draftsmen or adept at making understandable sketches.

Not so many, however, can make a good be-the shape, proportions, perspective, free-hand perspective drawing from an details, and light and shade object. a building, or a landscape, or can even copy pictures that involve a knowledge of perspective. Still more rarely is it possible for one not trained in art work to make a good, recognizable portrait sketch. Yet it is amazingly easy to do all of this with the aid of the device illustrated, which can best be described as "sketching spectacles." This instrument enables you to see what you want to draw as if projected right on the paper. All you have to do is to trace the outlines of the various parts with a pencil in order to draw everything just as it should

The construction of the "spectacles" is explained in the drawings on the following page. The operation of the device depends upon the two mirrors A and B_i placed in their boxlike container at the angles indicated, with their reflecting surfaces facing each other so that light will he reflected from one to the other.

The silvered coating of mirror A is contimuous and unbroken, but part of the silver on mirror B has been scratched out in a pattern of tiny checkerboard squares, as shown in one of the photographs. This removes approximately half the mirror



The estvered surface of m. rrur # in d vided into I 10 in squares, and the gliver to acretched away from every other division

surface and allows the eye to see an object placed behand the mirror and, at the same time, the image of another object reflerted from the tiny squares of silver that remain on the

glass.

The application of this to aketching is made clear by the diagram. The course of a ray of light from the subject to be drawn in indicated by the line of heavy dashes. This ray meets the surface of mirror A, is reflected to one of the silvered squares on mirror B, and thence to your eye, The course of a ray of light from the pencil point to the eye is

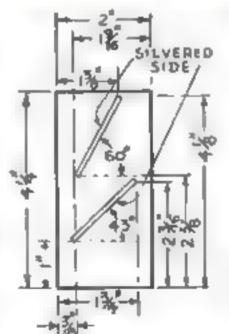
shown by the light dotted line. This ray goes straight through the clear glass of one of the scratched-out equares of trurror B. As a result, you see the pencil through the mitfor image of your subject, and can trace the outlines of the image easily upon the paper. Later, you can finish your drawing in any way you please-for example, in pen and ink or water-colors-without the and of the "spectacles."

To insure accurate proportions, you should take care to place the drawing board at a slant, with its surface parallel to that of tourcor A. Also, in sketching by artificial light, you must illuminate the pencil enough so that it is seen as distinctly as the subject to be drawn.

In the model illustrated, the box is made of composition fiber board except the two side linuits in which the slots for the mirrors are cut and the front piece with the eyeboles and nose "bridge." These parts are cardboard. Wood could be used throughout.

Mirror B was ruled in 1/16-in, squares, This is easy to do with a drawing board, T-square, and any sharp-pointed tool such as the V-gouge of a set of carving tools. Then every other square can be scratched out with a penkrufe while the

The shotching box as it appears from the B to about to be pushed into its grooves

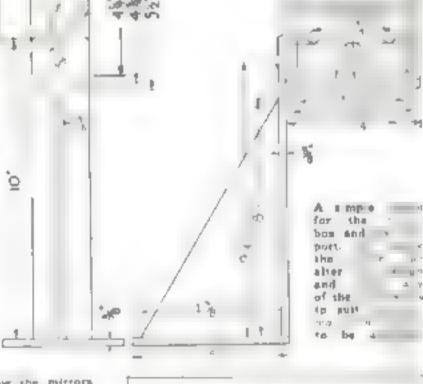


How the mirrors are placed a reation to the n-

mirror is pressed against a window pane Since successful sketching depends upon keeping the image of the subject immovable, it is necessary to guard against moving your head and eyes while sketching. This is accomplished by making a "spectacle bridge" for your nose and keeping the nose in contact with it. The box is of course, pivoted to the standard, and the latter is clamped to the table. Most persons will find it belps to close one eye when sketching in the outlines

Diagram abowing why the user is able see a smage of the subject as well as the point of his pone a

m partitioners about



Last-Minute Gifts for CRAFTSMEN

YOU cannot give an amateur craftsman anything that will please him better than one of the Popular Science Homecraft Guild construction kits listed on page 84 Three types are available-furniture kits with parts ready for assembly, kits containing only the raw marerials for furniture and hits for building beautiful ship models.

Cabinet for Small Tools Has Drawers Made from Cake Tins

A CONVENIENT Little chest of drawers or machinist's tool cabinet for your lathe tools, caupers, small files, and the like or for brads, screws, and bolts, can be made by utilizing shallow cake tins from the five-and-tencent store. The cabinet illustrated was made from five of these pans and some odds and ends of material picked up about the shop. The top and front are 3/16-m. pressed wood composition board, the back and ends 1/2-in. pine from an old packing case, and the bottom galvanused from from an old lawnmower's grass catcher. The bottom is bent up at the front edge to hold the door, which pulls out at the top and slides out of sight under the bottom drawer.

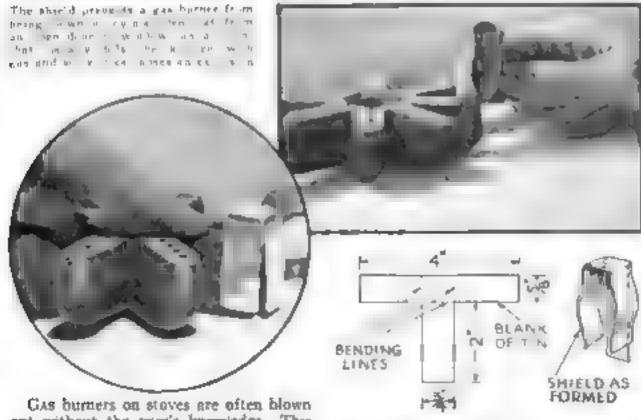
The drawing shows how the ends are rabbeted at the front and bottom, faside, to take the door and allow it to slide into the chest when it is open. The dimensions given are for time

1)6 by 7 3/16 by 10 15/16 in. The drawer si des are merely metal strips bent at right angles and fastened to the inside ends with small screws. The rolled upper edges of the drawers slide on these, but it gives an increased bearing surface and

When the door is c sea as a se

is stronger to solder a similar angle strop on the pan under the wire. The dimensions given allow ½ in, for the projection of the drawer-pull knobs, which can be made of metal or turned from wood. The bottom drawer is divided by soldered partitions into twenty-four compartments. Those who do not wish to do this much soldering may accomplish the same result by using mulfin tios. The shape of the wooden drawer fronts and other details are shown in the photos.—Porter Varney.

SHIELD KEEPS GAS FROM BLOWING OUT



Gas burners on stoves are often blown out without the user's knowledge. This danger may be removed by shielding two of the small holes in the burner so that they will relight the rest of the jet even though it is blown out. For the type of hurner illustrated, the shield is constructed from a T shaped piece of tin as shown in the diagram. This is bent so that it will

grap the sides of the burner firmly. For round or other varieties of burners, the shape and method of clamping can be modified as necessary. The back of the shield should face the direction from which there is most like shood of a draft or just of wind.—Leonard Mittell.

HOLDING SMALL OBJECTS WHILE PAINT DRIES

WHEN drying small parts that have been varnished, shellacked, or painted, it is always hard to find a convenient place to set them so that they will not be permanently marked where they come in contact with the surface on which they rest. To accomplish this, take a sheet of cardboard and through it stick a number of large thumb tacks in such a way that each of the painted objects can be rested lightly on three or four sharp points as shown in the illustration below. The points will leave no trace of their contact, and the air can circulate all around to facilitate the drying—hank W. Bentley, Jr.



Thumb tacks pushed through cardboard support small, freshly painted objects while drying

Fast and Exciting New Winter Game Played with Snowballs



"S NOW but," the latest in winter games, is an exciting variety of cold-weather baseball. The but is a .O-in disk of any thin, light material such as plywood, fiber board, pressed wood composition, metal, or even fabric. To this disk is fastened a handle that extends 20 in. In addition, a "snow catcher" or target is needed; this is a 24-in, disk with two short handles diametrically opposite each other. The cover of a bushel basket will do for making this.

One way to play the game is to allow the pitcher fifteen snowbolls. His score is the number of bits he makes on the target, which is manoeuvered favorably by the catcher while the batter tries to intercept the balls with the bat. The catcher must hold the target by both handles at all times. Any number may play, the game being something like scrub baseball

The regulation game requires two learns of four players each. The team at hat consists of three batters and one runner the team out, two anowball makers, a thrower, and a catcher. The players are stationed as shown in the accompanying diagram.

At the referre's signal the runner begins to run, and the thrower starts throwing at the target, which is manoeuvered favorably by the catcher. The batter intercepts the snowhalls either with his body or, preferably, with the bat. The makers supply the thrower with snowballs as fast as be can throw them.

When a hit is made upon the target the referee signals the hit, and play is surpended up if the runner returns to the starting line, then the second batter takes he place of the first batter, who is out, The thrower may also change places with a maker if desired.

Three outs, and the teams change places. One half hour constitutes a game, four comes is a meet. The score for a game is the number of complete circuits made by the runners. The score for a meet is the number of games won.

The rules are as follows

Thrower and makers must remain with-

in an 8 ft, diameter circle. Thrower may throw
only one bell at a time, A
ball that splits or bursts in
the sir does not count. The
thrower may use only one
hand between buts for
browing Time out may
be called for a fresh supply of snow, but this
should be done after a hit
unless the interval between
hits is unduly long.

The batter is untrammeled, except that he may not interfere with the

catcher. The batters may change places at any time, at the discretion of the captain, by calling time out. Any batter may be substituted for the runner after a hit

The runner may not interfere with any other player, and no other player may interfere with the runner. Runner must clear catcher and thrower's circle.

The catcher must keep the side of one foot against a short stake to limit his action. No hit scored with the foot off stake is a lowed by the referee. The catcher must keep a bland on each handle of the target, this scored when thrower or catcher are infringing the rules are not allowed by the referee, who stands on a base, the better to observe the runner's score.

lee skates may be worn if the game is played on a pond.—D. A. Butten,

TRICK CHRISTMAS CANDLES SHOOT UP WHEN LET

RED Christmas candles that will amaze and mystify the children can be prepared in such a way that when the wicks are lighted the outside which is thereby a shell, will shoot into the our and reveal a stick of candy. This is much more surprising and novel than an ordinary jack-in-the-box and is quite as safe

Make the randles by roiling shiny red paper into a tube. Each tube fits over a stick of candy set in a hole in a 3 in, wooden disk, also enameled red. In the top of each tube, resting on the candy, is placed a coil spring tied up with a cord, and the ends of the cord project out of the top to form the wick. The cord is prepared in advance by dipping it into a hot saturated solution of saltpeter with a little glue added. When the wick is lighted, it will burn down quickly and release the spring, and the candle shell will be shot high into the air.

A few candles prepared in this way will add to the gayety at any Christmas or New Year's party.—G. S. G.





DONALD W. CLARK

A Snappy Looking designs another simple new model portster Monoplane

OR model builders this little Gee Bee Sportster monopiane in an especially attractive design. If it is painted and trimmed as shown in the drawings, the finished model, even though it is rather small, will be what aviators cals a "next looking job," It has a wing spread of 8,4 in,, and the fusciage is 516 in. long. In relation to the full size plane, the scale of the model is 36 in. equals 1 ft.

Only fifteen parts are peeded. Cut. the fuselage from a blank 134 to. in diameter by 5% in, long (a section of wooden curtain pole will do! Saw the two glots to the tail end before shaping. Drive four thin brads into the sides of the body where marked and snip off the heads.

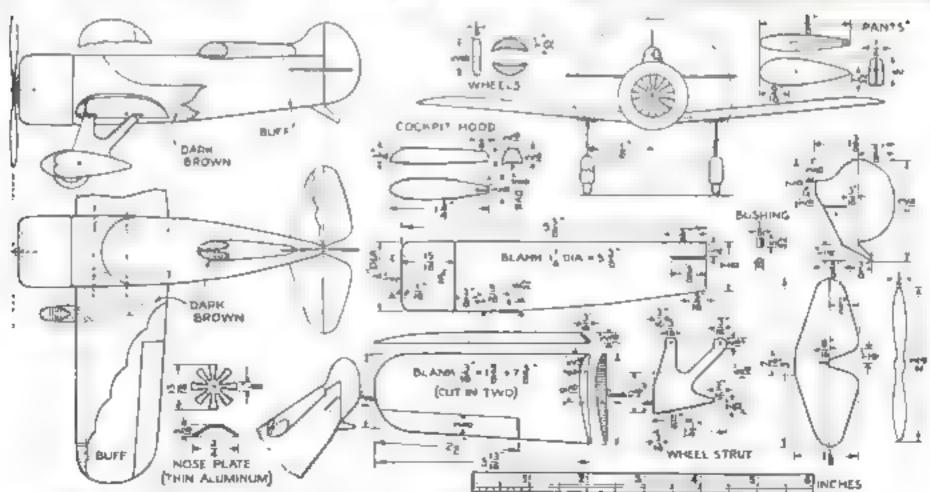
Cut out the propeller and the none plate from thin aluminum and the wheel strute from heavier stock

For the wings saw out a pine bank 3/16 by 156 by 756 in. Cut this in the middle and shape to the form shown. Drill holes to receive the brads in the fuserage

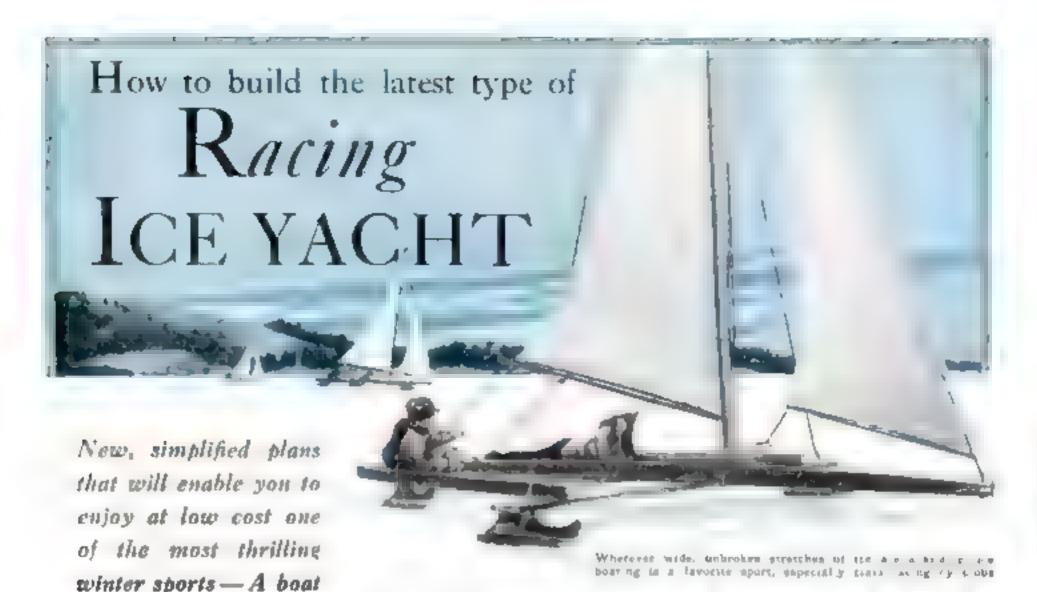
Carve the wheel "pants" from pine blanks 1/2 by 1/2 by 1/2 in Saw the strut slots before shaping and dr l. hoies for brads. Make one wheel, saw it in two, and fit the halves the bottom of the "pants" with a balround file,

Whittle the cockpit bood from a pine blank 5/10 by 34 by 134 in. Saw a slot the rear end to fit onto the vertical tounit. Fasten the hood with glue





Working drawings of the Gee See Sportster model. Any measurements not softcated can be found existly by using the each scale



By

with a 20-foot backbone

ALVIN M. YOUNGQUIST

KIMMING over a glased stretch of ice at forty or fifty miles an bour in an ice yacht—there's breath-toking sport for you! A violent gust drives the yacht forward in a new burst of speed, the windward runner lifts clear of the ice, and you are in the midst of a tense and thrilling struggle to prevent capsusing. But that only adds sent to your flight. The keenness of the sport lies in matching your skill against the strength and trickiness of the wind

If you do the work yourself, you can build an ice boat of the latest design for from \$35 to \$50. The yacht illustrated—the Comet—was designed especially for the club racing of the Western Michigan Yachting Association. These 150-ft (said area) ice boats offer the keenest kind of competition in class racing. They are easily assembled and come apart in thits convenient for transportation and storage. They can be handled without difficulty indeer sail, and their performance compares favorably with larger yachts costing twice as much.

The two most important members of the ice boat body are the running or runner plank (cross timber) and the backhone (fore-and-aft timber). The runner plank must be strong but not too stiff, as some apring in it is desirable. Clear edge-grained western fir 2½ by 10 in, by 12 ft, makes a satisfactory running plank. To save weight and to give greater spring, the plank may be tapered to 1½ in. In thickness at the ends, but this is not essential, and if tapering its thickness is done by hand the labor involved is considerable 1f, however, the plank is tapered, it should all be cut from the top side, the bottom being left straight

The backbone is also of fir, although sprace or white pine may be used for the ½ in, thick sidepieces. Because of its greater length, this part is made bollow to save weight. Two centerpieces 1½ by 2½ by 20 ft, and two adepieces ½ by 5½ by 20 ft, long are required. As long stock in more expensive to buy, the ¾-in, sidepieces may be made of shorter stock without appreciably weakening the timber. In this case there should be two pieces to a side, spliced over a block, the butt joints being staggered. The bottom 1½ by 2½ in piece is first secured to one side board

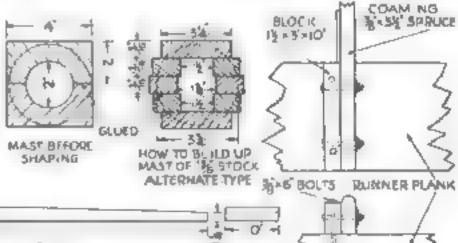
with water, rouf case a glue and eightpenny naus or screws. If clamps or weights are available the glue fastening will be all the better, and fewer nails need be used. Next bend the upper 11/2 by 21/2 in, prece over blocks conveniently spaced so that it meets the lower centerpiece at both ends and is raised about 234 in, for a parallel distance of about 10 ft. at the center of the backbone length. Then fasten it to the aidepiece with glue and nais. When the glue has hardened, fasten the second sidepiece to the part already assembled, Plane away those parts of the aidepieces that project above the tapered ends, set the nails, and fill the holes with a plastic wood composition or other filler. Sandpaper the whole smooth, ready for the finish.

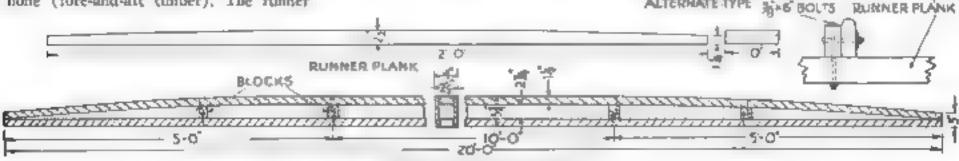
The backbone is fastened to the running plank by 13 by 1½ by ½ in. diagonal steel straps and two 10 by ½ in. hexagonal head bolts. Two small brace blocks are screwed to the underside of the backbone on each side of the runner plank.

The cockpit sides or commings and the stern piece or transom are made of 14 by

MAST, BACKBONE. RUNNER PLANK

Details of principal wooden parts. The deagn of the ice yacht was worked out by a committee of experts under the chaltmanship of Mr Youngqu at who has a naval architect.

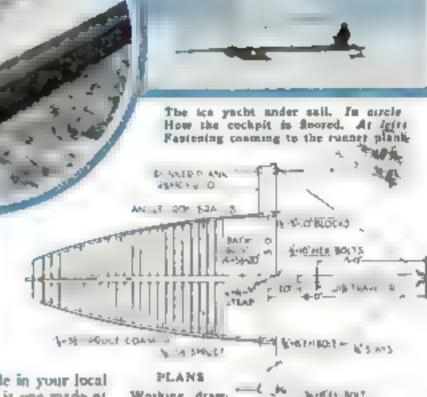




31/2 in, oak or 13/2 by 31/2 in, spruce. The bottom or floor boards are made of 36 by 6 in, spruce or pane spaced I in, apart and screwed to the sides and backbone with 13/2-in. No. 10 wood screws. The drawings show clearly how the cockpit parts are fitted and assembled

The mast may be made of a solid piece of spruce 4 by 4 in. by 20 ft., or of two pieces of sprace 2 by 4 m. by 20 ft. glued together, or of several 1/4-in, pieces glaed together as shown on the drawing, depend-





BILL OF MATERIALS

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Hardware and Ragging

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Blacksnu h Work

Rudder of and other form ofer. The short travelor

Foundry Work

Cost of the infiber shoes

Finishing Materials

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Same

8-64 main mil, area 112 square feet Note 105, area 10 equare feet 3- and winespood said cover

ing on the material available in your local jumberyard. The best mast is one made of two pieces each 2 by 4 in, with a groove cut in each piece to within about 1 ft of each end to make the mast bollow the parts being carefully glued together with casem glue. For a good job of glung, a dozen or more clamps are necessary

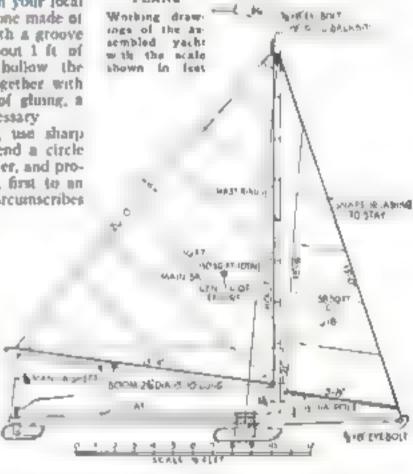
To make the mast round, use sharp dividers to inscribe on each end a circle of the required finished diameter, and proreed to plane off the corners, first to an approximate octagon that circumscribes

the guide circles. Then cutthe eight corners or edges down to the circles

The boom is made in the same manner, either of one piece or of glued-up stock, but it need not be hollow.

Apply a thin priming coat of white shellac. [ollowed by two or three coats of spar varnish

How to complete the ice yarkt will be told in the next same



FIVE BLOCKS FORM DECEPTIVE PUZZLE

A puzzus that is simple in solution, but more confusing than may appear to those unfamiliar with it, can be made of five

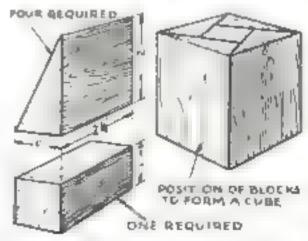
blocks as shown in the accompanying drawings. Four of these are wedge-shaped and measure 1 by 2 in., the length being equal to the hypothenuse side of the triangle -sightly less than 21/4 in., or 2 236-1to be more exact. The other block is I in, square, and its length also is nearly 21a in.

The fave blocks

may be placed together to form a perfect cube as indicated. They may also be placed to form a piece I by 214 by 5 in. This is

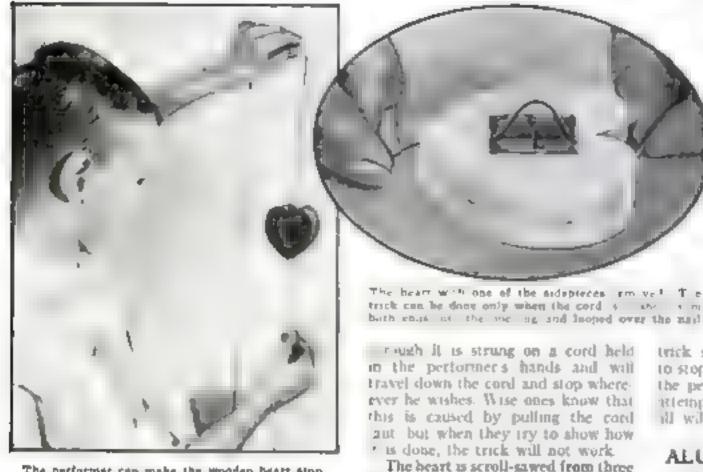
easier than forming the cube

The making of he blocks so that they fit accurately and form a perfect cube, in an excellent exercise in manual training, and the finished puzzle will amuse the grown-ups as wed as the children. Wainut or mahogany is an excellent wood to use .-- A. L. S.



How the blocks are shaped and assembled. Making them accurately is a test of skill.

Traveling Heart Trick Looks Familiar but Fools Everyone



The performer can make the wooden beart stop where he wishes simply by pulling the cord tout

THIS traveling heart, which looks like an old and familiar trick, is a good one for turning the laugh on those who always think they know how such things are done

A red wooden heart with a hole running

The heart with one of the aidspieces, am yelltrack can be done only when the cord a sav-

> rough it is strung on a cord held in the performers hands and will travel down the cord and stop whereever he wishes. Wise ones know that this is caused by pulling the cord aut but when they 1ry to show how is done, the trick will not work.

The beart is scroll-sawed from three pieces of wood, and an opening is cut in the center of the middle one. It is through this part that the vertical hole for the cord is drilled. At one side of where the cord passes through, a small brad is driven as shown into one of the outside pacces. The cord is waxed to make it stiff By pushing an inch or so of it late the

beart a loop will be formed within the cut-out space as indicated; then, by twisting the cord between the fingers, the loop may be made to fall over the head. The parts are glued together, sanded and enamered or lacquered red

Whenever the performer draws the cord taut, the heart will stop on the cord, Before handing it to a speciator, however, he pushes the cord into the heart and twists it in the Opposite direction from that in which it was originally twisted so that it will become disengaged from the brad. The cord then runs straight through the brart, and no one can do the

trick successfully. After trying in vain to stop the heart by pulling the cord taut, the person who is not in the secret will Ricings a variety of manipulations, but all will fail.-Kenneth Mi RRAY

ALUMINUM RAZOR HONE

When spread on a clean rasor strop. aluminum powder, or aluminum bronse as it is often called, imparts an exceedingly keen edge to a razor blade, according to an investigation recently made by a German engancer. To make this test, first rub soap on the strop, then spread a thin coat of the aluminum powder.-E. W.

WOODEN FLOWERS FORM NOVEL BOUQUET

ARTIFICIAL flowers are again in vogue. especially functful designs in metal. Equally decorative flowers, however, can be fashioned from wood with a lathe and a

Turn a hardwood cylinder 2 in. in diameter and 8 in. long. Mark off the lengths of the three bigasoms, as shown in the accompanying drawing. Leave 14 in, between each for culting off, and turn to shape. The sepals, it will be noticed, curl upward a little at the tips, and are considerably undercut, completing the line of the petals. The tips of the petals turn out also, but are only slightly undercut

Sand the blossoms and cut them off Divide the sepals into five parts, estimating with the eye, and cut in the divisions with a coping saw Trim from both sides with a chisel or knife, and gouge the sepals out on both siges of he center veins Cut out the divisions between with a \tool or 14-18. gouge.

With the same tool incise the divisions between the petals. The tips of the petals are double-pointed, with an inverted V-

cut between.

Lay out the side curves of the leaves on 14-m. stock, and after cutting them outline the edges, making some curve to the right and some to the left. Round the convex sides on a sanding drum, and cut grooves in the lower ends to fit the stems, I se balang wire for the stems.

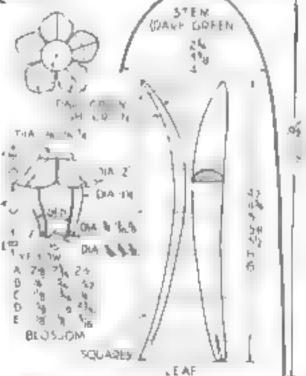
Choose a slender vase for the flowers. If the neck is not fairly small, cut a wooden disk to fit and pierce it with three small holes, through which the stems are thrust. Bind the lower ends of the stems

with wire, and arrange in the vase. Tie the leaves with wire sliding them around or up and down until an effective grouping is achieved, when they can be glued.

Paint the stems with enamel or larguer Color the convex sides of the leaves and



The completed bouquet has three stems and howers and seven leaves of different states



Suggested d mensions for the various parts The one real shown is the longest of the art

one side of each sepal dark green, use light green for the other sides, make the petals ted and the flower tips yellow, and add dashes of yellow in the petal divisions just below the sepals.—Enwire M Love.

CUTTING ROUND GASKETS

CIRCULAR gaskets of rubber, cark, and various compositions can be cut with a tool made from an old pair of heavy steel dividers. Heat one leg of the dividers, flatten it like a knife, and temper and sharpen it. - ARCHIE AMOS

EDWIN M. LOVE, noted craftsman, shows

How to Glue Up a
Perfect Bench Top

PLANK makes a poor cabinetmaker's bench top, for it wears rough, lacks rigidity, and persists in warping. A top glued up from strips is far more satisfactory

Mapie, birch, and apiton, which closely resembles Philippine mahogany yet is harder than oak, are excellent. For a top 16 in. wide, obtain ten rough 2 by 3 in. pieces. Lay them on sawhorses, choose the best ends for the trent and by inspection of the end grain, determine the heart (inner) and sap (outer)

edges, Turn the 2 by 3's so that heart and sap alternate.

To detect wind or twist in the pieces, lay them on a convenient support and night over parallel edged wooden stript testing on the ends, When roughing a piece on a small power jointer, he sure to hold it so that the high corner will be removed. Turn end for end and repeat. Then run the piece tall length until it is straight or if it is sprang, and the curve is uniform throughout. Use a hand plane

If a power dado is at hand, groove the joining faces for sup tongues in such a way that the pieces will go together with the top edges flush.

essary planing can be done on a small home-shop jounter

Slow-setting casein glue is probably the best—a mixture of 15 oz. water with 8 oz. of the adhesive Coat all of the joining surfaces.

Insert and (a)then the bolis; then apply all bar clamps at hand, alternately on one side and the other. If the assembly cups, clamp stiff slabs across the ends to bold them flat. Group the bar clamps around a bolt and tighten it; then move the clamps to the next. Finally, distribute the clamps and let the top dry

Test the top for wind, and dress it to a level surface by planing diagonally with a jointer plane. Then plane it with he grain scrape and sand it sounds and apply three coats of hot kneed oil

Mount the top with ling screws from underneath. Lock the front edge solid but make rectangular holes for the other screws to allow a night movement

To find out if the stuck is twisted, place parallel adged wooden strape or strate hiedges across it at both and and hight over

The glass top

is also tested for any twest

or wind, and

then dressed

level by pine-

ing it disgu-

The drawings

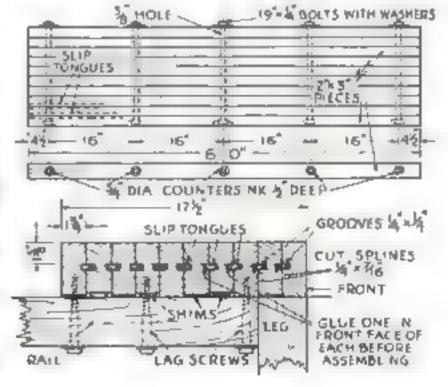
When jointed, clamp the preces together and square lines across for halt boles

to ake off the ribs left by he machine with an extra shaving ou, of the center so that the edges will be forced tightly together

Joint the better edge, gage both edges for the greatest thickness of the material, and plane off to the line. Do this with all pieces, clamping them together two at a time, in succession, to see if the joints are good. Finally clamp all ten together so that lines can be squared across for locating the bolts. Number the front exist before taking them apart.

Square across the faces of the pieces at the bolt locations and scratch short lines across these gaging from the upper edges in all cases. Mark the intersections by pricking deeply with an awl, Bore the holes with a skean but

In grooving the pieces, a block is clomped behind the fence to keep it from toringing



Picturesque Deck Structures make our



By Capt. E. Armitage McCann

UR new 3-ft, model of the United States batticship Texas has been carried in previous installments (P. S. M., Nov. '32, p. 67, and Dec., p. 71) to the point where the tripod of the foremast is in place, capped, as it were, by the main battery control station.

The Texas is one of the most powerful battleships affoat. How high she tanks among American ships is indicated by the fact that she is the flagship of Battleship Division 1 of Battle Force, U. S. Fleet She is therefore a particularly good subject for the model maker and can be built with equal assisfaction as an exhibition model for display purposes or as a power-driven working model

Resting on the main battery control station, which is marked 33 in the drawings published last month, are the secondary battle top (34) and the main battery and direction top (35). On all three (33, 34, and 35) I merely pointed the windows.

Underneath this structure there is a platform (32), cut to fit half around each leg of the tripod. This platform and the other deck can be kept in position by driving pin points into the struts. From the platform hangs the bell (37), about 16 in in diameter

Vertically under the front edge of 3.3 there is a clock with one black hand and black figures 1 to 10, called the "concentration dial." This is a thin sheet of brass with an arm soldered onto the back and naised to the tripod (see 36a).

About the tops are the yard (38) and the mast (39). These are fastened to the back with staples. In front there is a forked wire (40) with the ends driven into the top edge of 33, and to the end of it is soldered another thinner forked wire with its ends set into the bottom of 33

The mast proper and the signal mast, or topmast, are made in one. It is stayed with a thin wire from the position shown having six very small beads rove on. The wire is soldered into a bole at the point of the forked wires (40). The breast stay, which comes from the same position, has six beads, passes through a bole in the yard has six more heads, and is fastened to a staple in the tripod—on both sides, of rourse. A touch of glue will hold the beads in their proper positions.

AT THE top of the signal mast there may be either a plain glass bead, representing a light, or an ordinary truck, which had better be left off until the flag goes up.

The projections at the side of deck 20 are for ladders, metal or wood, with No. 24 brass wire posts and a handrail bent to shape and soldered to the rail stanchions.

These rail stanchions should be the two-

ball, 34-in, size with shanks long enough to stick in the deck below to support the edge of the deck as illustrated above.

with which the ericle is mainly concerned

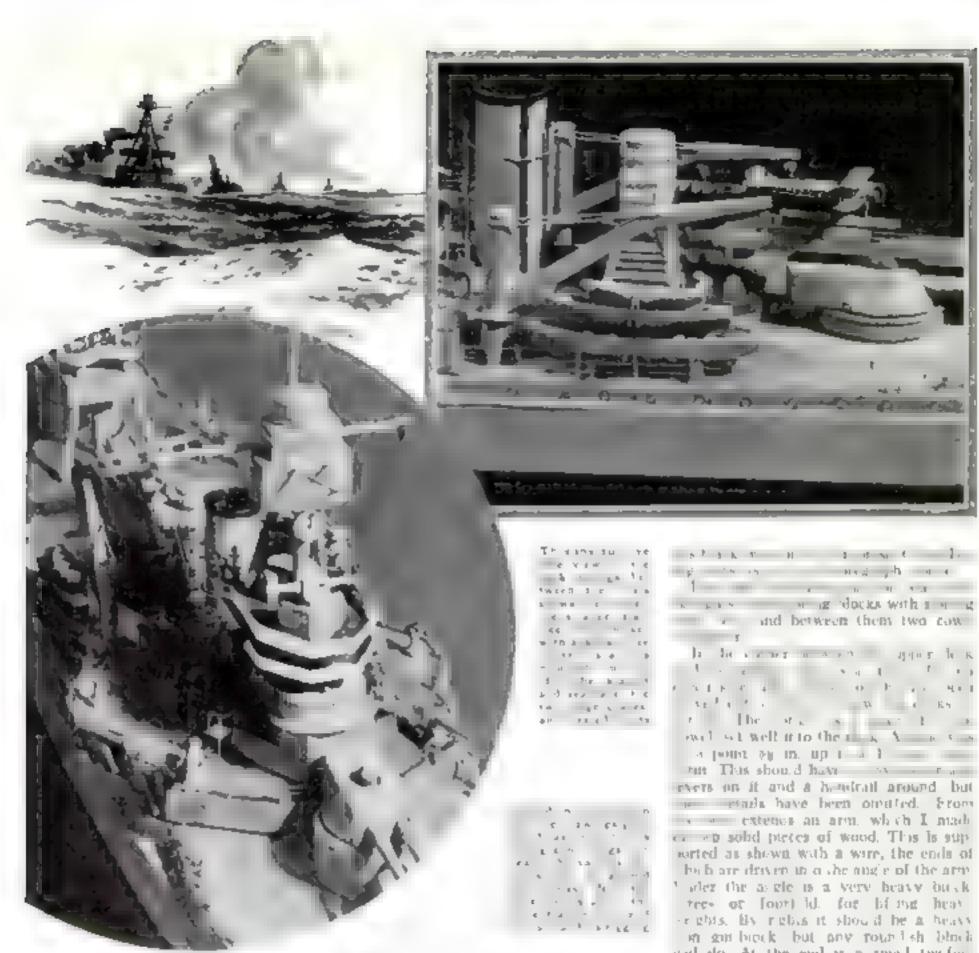
The guns and other fittings for these decks will be described later

While all this work is under way, the painting of the buil should be carried on The model should have the usual three or four coats of flat white, rubbed down then, below the water line several coals of Indian red (red ston oxide). Everything above the water line should be painted a light blue-gray (battleship gray) except decks 17a, 20, 27, and 29, which are Indian red, the rim around the top of the funnel which is black, and the weather screens, which are white The gray is merely white paint with a little black added and a touch of blue to brighten it.

The main deck and deck 17 are left a natural light wood color and variabled, but with no gloss or shine. If desired, a stripe about 36 in, wide can be stained brown (to represent bard wood) around the edge of the main deck and all erec-

tions on it.





The actual water line is not shown, but instead there is a black stripe representing he boot-topping, 1/4 in, above and 1/4 in. below the water line. The simplest way to get an even stripe is to let the red and he gray meet; then, when quite dry, mark the position of the boot-topping and fasten above and below it a strip of gummed paper or tape, painting all between with one or two coats

FITTED into the after edge of the upper deck is another deck called in the merchan, service the fluidley." This covers the fireroom (17a). It is 36 in, thick and has vents painted on the sides, and the deck is red. At the fore end is erected the funnel (41) This can be made from thin metal tubing or by soldering a piece of shim brass around a stick and then withdrawing the stack. In the second case, place a disk about 1/2 in thick in the lower end to preserve the shape of the funnel and to aid in gluing it down. The top can be curied over or have a narrow band sordered on. At the base a square piece of wood should be fitted for the cas-

ing; it is 34 in. thick with a hole bored for the funnel, and from this hole it slopes down to nothing. If preferred, it can be made from several pieces of shaped from plastic material

On the foreside is a siren; abaft are two thin exhaust pipes; and on the port side, a 3-32-in, funnel as high as the main funnel. These can all be held in position with a piece of thread or wire around the funnel; pass a turn behand each piece The funnel should be painted gray outside black more and black around the rim.

The base of the next little tower (auxiltary fire control) is built of a 1% in, square piece of wood 1/4 m. thick, tapered toward the top. Nailed to the corners of this—it is marked 42 on the drawings-ere four angle irons. The cross strips of metal preferably should be on the inside of the angle trons.

Houses 43 and 44 are made of wood to the shapes shown and are glued together Cuts are made underneath 43 so that it can be pressed onto the angle irons. This part is all gray except the windows, and the base 42, known as the "potato locker,"

and the second section of the section of the second section of the section of the second section of the section of th where we are docks with a mile and between them two cow la fie a constant and apper le s. trea orange The state of the s and set well into the research as a second а роша од на пр т а 1 tift. This should have the same of a second evers on it and a handrail around but reads have been omated. From · extense an arm, which I made er on solid pieces of wood. This is supsorted as shown with a wire, the ends of but are driven in a the angle of the arm oler the acre is a very heavy buck rees or foort id. for hi me hear rights. By rights it should be a beavy in gir brock but any roundsh black will do. At the end is a small twofour block. Each block should have a hook attached, For falls I used thin wire, reeving them through the arm but not so as to show on top. The ends lead down inside

THERE are three boats prested, on each side of the fiddley-a motorboat, motor sailer, and whaleboat. The shapes of these will be seen in detail 11, I gave them all thwarts and in the lower ones asided propellers and blocks to represent the motors. These nested boots are piaced on chocks, natical down, and held with a lashing around all. You may in addition. correctly have Admiral's barges, punts, and other small craft on the fiddley

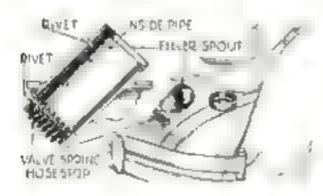
Next month we shall erect the mainmast and complete practically all the deck

It should be remembered that most of the small fittings required for this model may be bought ready-made, if desired, from model supply bouses. When time is an object, this is advisable and, in some cases, less expensive than making them oneself. The larger dealers publish wellillustrated catalogs.

Valuable Kinks for Your Car

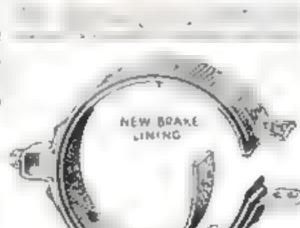


Y MEANS of the simple rigging shown above, the curtain at the rear wondow of a sedan can be adjusted to any desired position from the driver's seat A pastic wire, wound around one end of the curtain roller and guided by means of screw eyes to the driver's seat, forms the handy control. Sufficient wire should be wound on the tolier to provide some spare even when the curtain is lowered to its fullest extent. This arrangement is par-Licalarly handy when you are driving alone. since the rear custain can be lowered by simply pulling the wire. To raise the curtain it is necessary to give the wire a jerk and thus release the spring in the roller. Those who drive at night will appreciate the convenience of being able to adjust the curtain when headlights from behind build one.-W L



Guarding Gasoline

GASOLINE steeling, the latest racket of petty thieves, has led many car era to install locking caps on their gasoline tank filler spouts. A simpler method of protecting your gasoline is shown in the sketch above. A piece of valve spring is fastened inside a short length of pipe which in turn is fastened inside the gasoline tank filler pipe. The soring, held in place with a long rivet. fashioned from a nail, will not interfere with the nozzle of the regular pump hose but will not allow a syphon tube or suction hose to be lowered to the surface of the дазопре.— J W.A.



OLD LINING USEC AS A FILLER

Double Brake Lining

ON OLD care, badly worn brake drums sometimes make it impossible to adjust the brakes so they will hold even when the linangs are relatively new. This can be remedied by placing the old lining under the new as a filler. When applying a new lining, remove the old, place it under the new, and rivet them both in place with the new one on top. The double thickness makes up for the worn drums and allows you to get the full wear our of new linings. This can be used on internal, as well as external brakes.—S Z



Old Brake Lining Used as

Filler to Take Up Slack in

Worn Brake Drums-Handy

A Parking Light

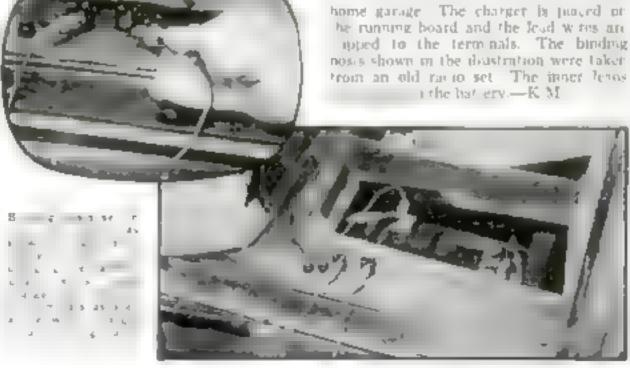


FOR the driver who does a lot of parking at night. the easily-constructed automatic backing light illustrated above and at left is good insurance against scraped and dented fenders. The switch opera ed by he gear lever, is an

ordinary telephone jack with its casing removed. It is supported on an angle iron placed in front of the reverse position of the gear shift. An extension arm clamped to the shift rod closes the two contacts on the jack when the gears preput in reverse.-E P.

Charging Battery

TWO blinding posts, installed on the front seat support, simply the probof there are the car battery in the t the hat ery.-K M



POPULAR SCIENCE MONTHLY

Homemade Chasing Dial for Lathe

Aids in Cutting Threads

BY HOLT CONDON

Threads can be cut in the lather more quickly and with greater cuttainty if a charing dial is made and attached on the end of the apron wheel will engage the lead acrew during the dulifu operation

shear and lead acrew in their proper relation to the carriage apron. This fixed the dimensions and approximate form of the indicator shell, a pattern for which was made and a casting in aron ordered. This casting, chucked bottom end out, was bored through 1/4 in. and counterbored to inclose a worm wheel of 32 teeth and 1 in. face. A piece of stock was next chucked, turned off to run true, and the casting wrung on for facing and recessing the top or dial end.

The core, which combines dial and shaft, was turned on centers from machine steel. A flarge 1,6 in, in diameter and is in, thick forms the dial, and the other end, stepped down for a length of \$6 in, takes the worm wheel which is bered in. This small end was threaded with a 1/2-in, 70 S.A.E. thread for a standard

a 1/2-in. 70 S.A.E. thread for a standard but, faced off than. This but locks the gear on the shouldered shaft and allows for angular adjustment between gear and

for angular adjustment between gear and dial

Graduations were planed in the dial by means of a lathe bet mounted on its side, with the work on centers, Indexing was accomplished through a 32-tooth gear placed on the stud—four teeth for each of the eight divisions. Numerals were stamped, and then a light facing cut was taken to clean up. A small hole drilled in

the ram of the shell leads oil under the

flange of the dial and serves as a fixed

UTTING throws in the lathe requires a certain knack and the proper equipment if it is to be done rapidly. As skill comes only through practice and as the necessary tools may be made in the home workshop, there is no reason why the aniateur should shy at this process. Knowledge of the principles involved is, of course, necessary, but may be had at nominal cost by writing to lathe manufacturers that advertise practical booklets on lathe work.

It is entirely possible to "chase" threads without an indication did cross-slide.

It is entirely possible to "chase" threads without an indicating dial and cross-slide stop—the two homemade tools to be described in this article. Their function is rather to remove uncertainties and to cut time and labor on this operation.

Cross-slide adjustments, as well as feeds at the compound slide, may be gaged by the graduated collars on the actuating

screws. This is a slow method, bowever, and often leads to trouble through failure to take care of lost motion in the screw -- disadyantages which may be overcome by a cross-slide stop. Through its me the cutting tool may be withdrawn and returned to the previous cutting position with certainty. When boring threads, the

screw is not passed through the clamp as shown, but contacts on the inside surface, the tool being drawn back to the limit

of the stop for each cut.

To bring the cutting tool into the spiral of the thread for each cut after disengaging the spirit nut from the lead acrew, the starting position of the carriage may be located on the ways with a stop and the spindle and lead screw gears chalked to show their angular positions. The stop can be made by running a cap screw into

CASL I

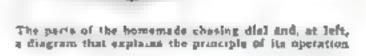
CASE 1 EXAMPLE HIS THREADS PER INC. CLOSE AT DIAL 1 AND 3

" 2 " 13 " " 12 54

" 3 " (ANY EVEN NUMBER) " ANY LINE

the tapped saddle of the machine where spot-faced for the follower rest, the screw head to bear against the tadetock base. This arrangement, too, is a makeshift and requires much "horsing" of the belt to bring the chalk marks into position. The value of a chasing dial that indicates this spindle + screw - carriage telationship is therefore obvious.

As a preliminary to starting work on this attachment, a full size drawing was made showing in cross section the lather

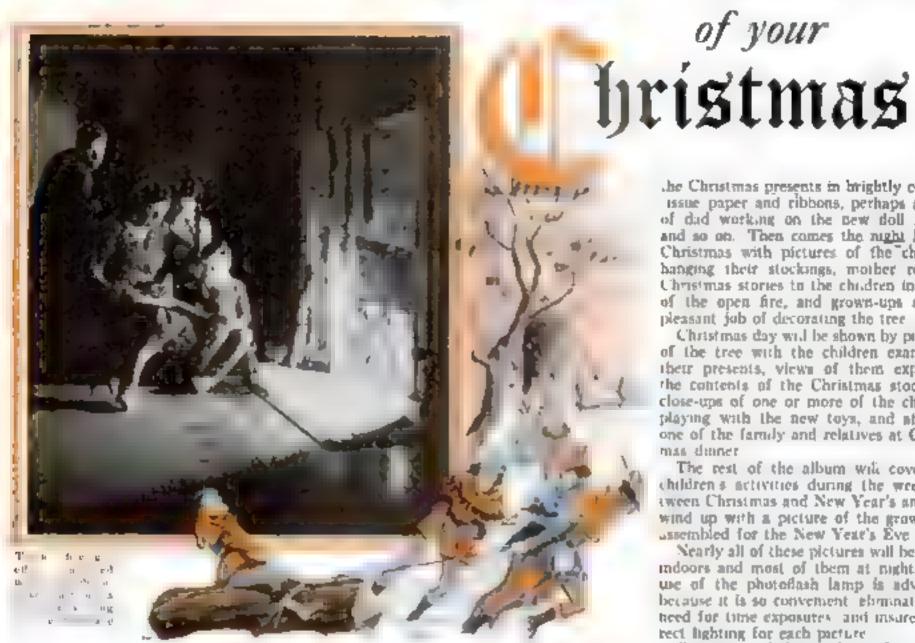


point against which to read the revolving dial during a thread cutting operation.

The writer cut the gear or worm wheel on his lathe by the hobbing process—an interesting problem, but a long story that will have to go over into another issue When assembled on the shall, it has within the shell, the wall of which was cut away at the back to admit the meshing lead screw

The flat pad on the side of the shell was cleaned up parallel with the bore and a spot filed flat on the end of the lathe aprou to take it. (Continued on page 89)

Keep a CAMERA RECORD



F THERE is one time of the year when every amatrue camera should be in use It is during the Christmas season. There are, in fact, so many chances for good shots over the holidays that some amateur photographers make a practice of putting all the pictures taken

during each Christmas season in a separate small album. The album then forms a pactorial record of the bigh spots of our year a festiva les-

Regioning for example a few days be fore they may the album will start with the details of the boliday preparations There will be pictures of mother wrapping

the Christmas presents in brightly colored issue paper and ribbons, perhaps a shot of dad working on the new doll house, and so on. Then comes the night before Christmas with pictures of the children hanging their stockings, mother reading Christmas stories to the children in front of the open fire, and grown-ups at the pleasant job of decorating the tree

Christmas day will be shown by pictures of the tree with the children examining their presents, views of them exploring the contents of the Christmas stockings. close-ups of one or more of the children playing with the new toys, and at least one of the family and relatives at Christ-

The rest of the album wik cover the children's activities during the week between Christmas and New Year's and wilwind up with a picture of the grawn-ups assembled for the New Year's Eve party

Nearly all of these pictures will be taken indoors and most of them at night. The we of the photoflash lamp is advisable because it is so convenient eliminates the need for time exposures, and insures cortect lighting for each picture

This outline indicates just a few of the possibilities for interesting flashlight pictures during the holiday season. In general, any activity worth watching is also worth photographing. Once you get to thinking in terms of pactures, the chances for good shots appear almost endless

One point, at least is in your favor when you take pictures around Christmas time

\$100 in CASH AWARDS for Christmas Photos

No statue how little experience you may have had in placedrap's your chances are just as good as these of ans other reader to carry off one of the y's cash prizes amounting to \$100 in al. which we are offering for the best in dose the senies photographs. The awards will be made for those persures that are most successful in conveying the spirit of Christmas-pict res of the hied you would take for an a hom york us Mr. Ryder describes in the accompans of arr ce

Take a number of views pick out the hest and send a print of a together with he negative to the Photographic Fottee Pres in Sens a Miss Sell Fourth Avenue, New York, not later than February 1, 1933. Mark your entry "Christman Photo Contest." The list of six prizes is as follows:

FIRST AWARD	150
SECOND AWARD	2.5
THIRD AWARD	10
FOURTH, FIFTH, and SI' AWARDS, \$5 each	XTH 18
TOTAL	5 00

The reason why even a beginner has an excellent chance in this carrest is because the introduction of photodash by by his avercome practically a speold a figurage of taking adoor oboto graphs. There is no longer and need for uncertainty I you to low necess tions the residue of 11 he good. The contest a stended primar of inches or age you to learn this modern method of making flashlights, although developht

or are kind of relamination or findinglit. may be sed the arighting oil printing may be done by a professional hat the pieture itself must be taken by se amoteur. The only other requirement is that it be taken within the two mention of December 1932 and James

Write in the back of the next what this or flastlight and I flastligh which from You mus enter several putates from with hit no entries a he tel and The onest a open t) all except employees of P In the content entry to the content of a I be awarded my prize to or The pretures will be judged on their photographic qualities and the appropriate-ness and human interest of the subject

Tom finds out how to picture

CHRISTMAS JOYS AND THRILLS

DON YOU SUPE KNOW MON TO TAKE MODIA PCTURES! AND YOU SAY BHAT GE MAZDA PHOTOFLASH LAMPS MAKE THEM AS EASY TO TAKE AS SHAPSHU'S IN THE SIND BOY THATS WHAT WANT FOR SIME REAL CHR STMAS PICTURES



DARLING, THESE NEW LAMPS ARE GOING-TO GET US THE CHRISTMAS PICT, RES WE VE ALWAYS WANTED - PCTURES THAT REALLY SHOW THAT THRILL OF WONDER AND JOY WHEN THE CHILDREN CATCH THE R. F. RST 5 GHT OF THE TREE ON CHRISTMAS MORNING





G E. Mazna Photofiash lamp for action shots, bubles, partles, pets











G. E. MARDA Photoflood lamp for time exposures, portraits, interiors

All of these Unstructions as well as this indoor snapshot of Touts were taken with G. E. MAZDA Phonefash lamps.

TAKE PRIZE PICTURES IN YOUR HOME!

YOU CAN TAKE PICTURES as natural and striking as these with your camera this Christmas . . . if you use G. E. MAZDA Photoflash lamps. Flash' and the scene is yours before subjects wink an eye. Catch the spontaneous joy of Christmas. No noise, smoke, smell or muss. Each picture calls for a new lamp.

And for time exposures . . . portraits . . . interiors and other "at II" pictures, use G E MAZDA Photoflood lamps. They enable ordinary box or folding type cameras to get beautiful, clean-cut pictures with exposures of 1 to 5 seconds.

MAZDA PHOTOGRAP LAMPS

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some lamps and take your own prine pictures. General Electric Company, Nela Park, Cleveland, Ohio.

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The joys of the season are reflected in the expressions of children and grown-ups alike, and your subjects do not have to be targed to look pleasant. But even the happrest child will become fretful if you insist on formal poses and keep him waiting too long.

The advice often is given to take your pictures without the subject's knowledge so as to get natural and easy expressions. That's good advice, but you can't always follow it. The wrapping of the Christmas packages, for instance, may be going on at a table in such a position that the only possible picture

back view.

The solution is a compromise. Tell the grown-ups or children that a picture is to be taken and get them in the proper position. Then suggest that they go shead with whatever they are doing while you get the camera ready

you can take unawares is a

Fiddle around with the camera adjustments, look into the finder several times. hold the phototlash lamp in various ways as though studying the proper lighting effect. Keep this up till your subjects lose interest in your preparations. Then watch

for the pose and facial expressions you want and when you see them, snap open the shutter and touch off the photoflash.

I have tried this trick several times with excellent results. Often, if the room is brightly lighted, your subjects will not notice the flash at all. Even if they do no barm is done, because the quick, silent flicker of light is all over and the picture safely recorded on the film before the involuntary twitch of an eyelid can take place,

There are other trick ways to get easy natural expressions in your photofiash pictures. One is to put the photollash bulb in a property placed floor lamp or wall bracket before you assemble the group. After you have them arranged as you want them, ask everybody to hold still for a short-time exposure. Of course, they will all freeze into the characteristic

posed expressions.

CTUALLY go through the motions of A taking a time exposure. An easy way to accomplish this is to leave the shutter set on "hulb." Then when you start the take exposure, press the release just as you would for a time exposure. Of course the shutter simply opens and closes at ance as you release the pressure on the button, and the film is not affected by the fraction of a second exposure if there is only art.ficial light in the room. At the end of five or ten seconds, you press the button again and hold the shutter open, at the same time announcing loudly that it's all over

At your announcement every face in the group will relax, usually into a natural sinue and that will be the signal to



Avoid having the tree in the exact center of the picture, and heep the children playing with toys to they will not stare at the camera

touch off the previously prepared photo-

There are many possible variations on this faked time-exposure idea. You will have to arrange the details to suit the circumstances and the subject. Don't try it with daylight in the room unless you do it in such a way that the shutter will not be open at all until just before the ilash. Otherwise a well-lighted face or two will register twice and give a double caposure

The photograph of the Christmas tree is one of the most important in your holiday album and also one of the most difficult to take. The dark green needles of the Christmas tree foliage reflect but little actinic light. The tree itself therefore photographs almost black and you have to depend on the orgaments for the high-lights.

The choice of the decorations and their arrangement are most important. Avoid dark red and deep orange colored glass bails. Use white tinsel; the reddish, copper colored tinsel photographs as a dirty, speckled gray

If the tree is lighted with small electric bulbs, remember that the deep red and ocep green built will not register on the film at all. White, blue, cream, and light orange buibs register best in

the order named.

Of course the effect of the bulbs in producing bright spots in the decoration of the tree depends on how you make the exposure. The longer you leave the shutter open before you shoot the photoflash bulb, the brighter will the bulbs appear in the picture. The photograph on this page shows a typical Christmas tree stene where the shutter was open just long enough to shoot the finsh.

If you wish the Christmas tree bulbs to show brightly, first be sure that none of the ordinary lights in the room are within the field of view

taken in by the camera, and do not have

the room too brightly lighted.

Lse verichrome type film to prevent the bright points of light from spreading into hazy blurs and open the shutter four or five seconds before you shoot the flash. The fact that the children move during this period is unimportant.

IN MANY cases it is not possible to place the camera so as to include the whole tree. Don't let that worry you. A pleasing arrangement of one or more of the children with part of the tree as a hackground is just as interesting

The worst possible Christmas tree picture is one showing the dark mass of the tree looming up in the exact center of the picture space with neither its base nor its top within the limits of the view

Another holiday season picture that usually taxes the amateur flashlight photographer's ingenuity is the view of the family and relatives assembled around the Christmas dinner table. With the table fully extended, it is, more often than not, quite impossible to place the camera where everybody will be in the picture. Of course, if there are double doors leading into another room, you can set up the camera in the adjoining room and place two photoflash bulbs. one at each side of the door, where the partition will keep light from reaching the camera lens. Be sure to place the camera so high that those nearest will not block off those on the far side of the table

When there are no double doors, the only solution is to take the group in sections, shooting across the table.

Our BLUEPRINTS Insure Success

BEFORE you begin to build any project whatever in your home workshop-whether it is something described in this issue or not-look up the list on page 78 to see if blueprints are available. If they are, take advantage of them.

Our blueprints cover many subjects, and they are all large, clear drawings so carefully detailed that it is a pleasure to use them. They will do more than any other one thing to insure your success.

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I is small simple, ampiete I real full-fledged moviecumera, Poica

an p 5 9 44

attick or fill a tra-

Il cuts 61m cust ex-

Whew. Who's cooking cauliflower?

WHEN you smoke a foul, recking pipe, you may think you're getting away with it with your houres. But you can't fool a bird,

For your own take at well as others

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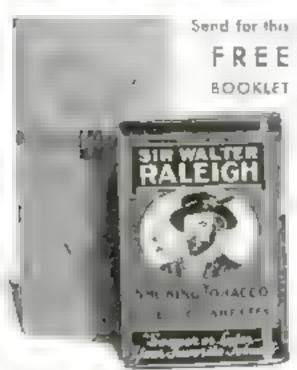
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It's 15" - AND IT'S MILD R

Building a Model Railway Signal Bridge

Signal Driage and other hints

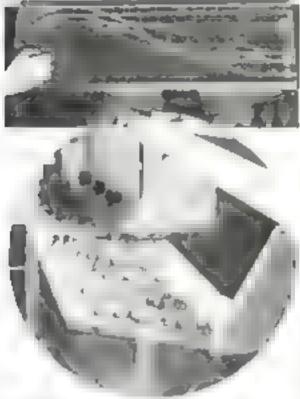






bottom of the hole. The retating table, which carries the track, should be strongly constructed of wood and fitted with a pair of wheels at each end. These wheels carry the load.

This method of building a turntable also can be used with the regular standard and "O' gage sheet steel track. Instead of laying a rail around the edge of the bottom of the hole, a thin strip of wood can be bent into place. The four wheels may be aken from a discarded car.



Terminal Layout Shown on Indicator Board

I'd on nated and cutor boatd closed as a see and open to show the concealed woring

MINIATURE dagram of a model A reway terroral with white lines winter on a sack panel is shown above bet on these lines at the proper points are tiny jeweled lights, switches, and push trictions. The push buttons are used to supply current to the sidings. This is good practice because it makes it impossible to forget to cut off the current to a siding. The snap switches are used to throw on he jeweled indicator fights to indicate when track the train will take in coming and the variety

figurese, such complicated terminal construction is not possible with sheet steel track, but the terminal board can be used for a simpler layout if desired. The knob shown at the left end of the board controls the current to the locomotives while they are in the yard and is connected to the shoostat at the far end of he board as shown in the open position in the second photograph.

Holding Small Nuts

IT is often difficult to hold small nuts in inaccessible places. An effective method is to solder a wire or a strap of brass very igh ly across the hole in the nut and then send this handle so the aut can be placed wherever necessary. When the bolt is screwed through the nut, it will break the solder.—C. M. B.



77

GoodbyE SANDPAPER CHIN



Here comes the new

DUPLEX SAFETY RAZOR

VERYBODY wonts on ALL DAY shove and here it is! Try this NEW rezor —and get rid of that "sondpapery" feel-Ing that cames a few hours after showing. It's all in the long blade—the shav-Ing angle—and the design! Simple and sure. Nothing to learn—just shave! Note these important features:



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that there are two or more blueprints in the complete set. If the letter "R" follows a number, it indicates that the biveprint or set of blueprints is accompanied by a special reprint of the instructions originally published in the magazine. If you do not wish this reprint, omit the letter "R" from your order and deduct 25 cents from the price given. Reprints alone are sold for 25 cents each.

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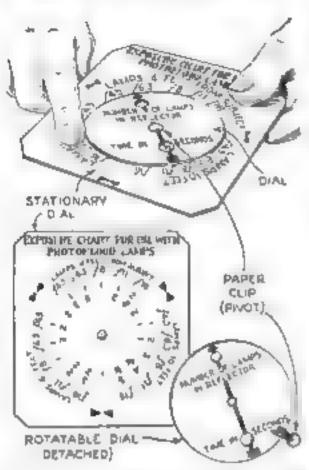
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Popular Science Monthly

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SIMPLE EXPOSURE CHART AIDS IN TAKING GOOD FLOOD-LIGHT PHOTOS



How the chart appears in use, and the parts appareted to make the construction Clearer

AN EXPOSURE chart to guide you in your use of the new flood-lighting lamps for indoor photography can be prepared easily from good quality white cardboard, Bristol board, or cellulaid

Cut a piece 3 in, square and, by drawing diagonals, find the center. Punch a 1/4-in hose at this point. It is also desir at ie to cut the corners from the square so it will not eatch in the pocket. Next cut a 2-m diameter disk out of the same material and punch a 1/2-in, hole through the center Draw an arrow through this center as shown. On this arrow, 🧏 in. from the pointed end, punch or cut a 1/4-in, bale, and another 14-in, hole 1/2 in, from the tail end of the arrow Letter beside the first 14-in hole "Number of lamps in reflectors," and alongside the second, "Time in seconds."

Fasten the square and the disk together

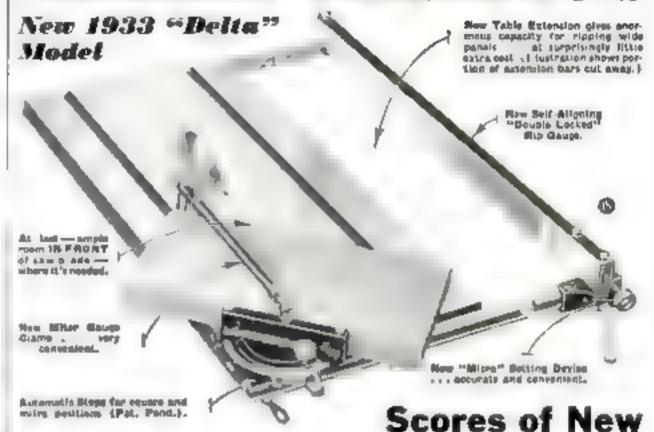
TIME EXPOSURE TABLE

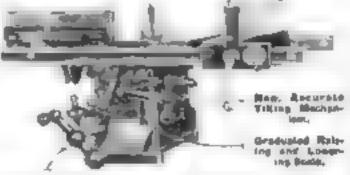
For film of verichrome and plenachrome type

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6 ft.	F 4.5 F 6.5 F 8	1	1
19	F 11 F 16	1 2 2	1 2 7 4
ID fi	F 4.5 F 6.5 F 8	1 2 3	,
.,	F 16	4 5	3-5

North For inexpensive cameras use largest stop opening and exposure data gives above for F 18. For ordinary roll falm use twice exposures given above

New Circular Saw Astonishes Woodworkers





Improved Building and Lamering Michaelens -





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Radically New Design

Features

DESIGNED completely new from the ground up, this latest 1933 "Lielta" haw has every feature that wondworkers have wante for years and yet it is no moderate proces as to be within the reach of a list offers extra source in control the saw hade where it smost needed, piquallthe advantages of a table 4 feet square, at a fraction of the or had root of a linge lable. If more purposes serves in apportunit improvements are exclusive to nees it the a choice of ses any ava dible. Taleda estginee a after thomosph reds on all york the TILTING TABLE design (no til ing a nor as seing he most efficient and pracheat For full details, see the new 1935 Delta Catalog

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A. J. PRINCEN

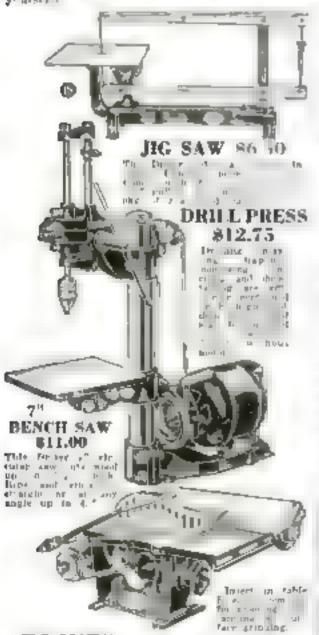
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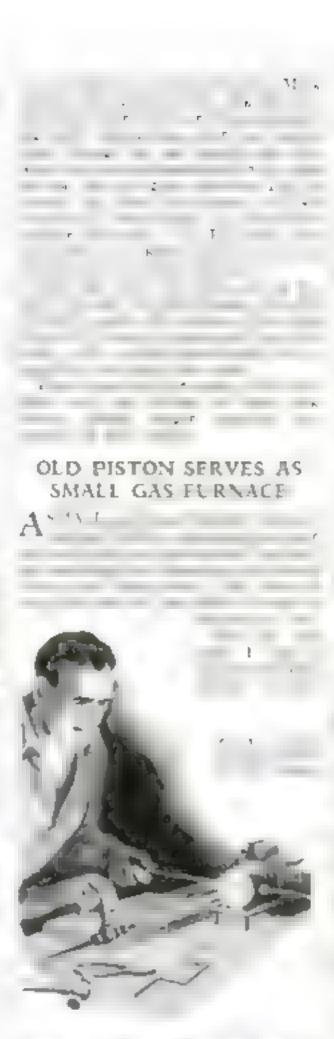


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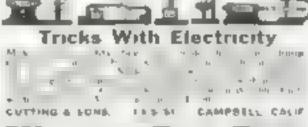
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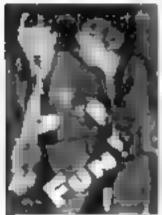


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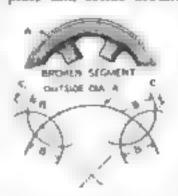




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FINDING THE DIAMETER OF A BROKEN PART

TO FIND the diameter of a broken circular part of which only a small segment remains, set the piece on a layout plate and scribe around as much of the



outside diameter as still exists. This line is marked A in the accompanying diagram. Set dividers to any convenient radius B and scribe four arcs as shown from four centers convensently to-

cated in pairs on line A. Let each pair of ares overlap. Then use a scale or straightedge to lay off lines C passing through the points of intersection of each pair of accs. Where these two straight lines intersect is the desired center.-Dox R. HAMMITT.



P YOU have kept all the 1932 issues of POPULAR SCIENCE MONTHLY as so many readers make a practice of doing, you own a gold mine of up-todate home workshop reference matemal-almost 400 pages relating to the shop and to craft work in all its phases, including practical suggestions in regard to automobiles, and up-to-theminute radio information. All you now need to make this great mass of valuable information immediately useful is a complete alphabetical index, so that you can find anything you went in an instant. An index for the twelve issues of 1932 has been prepared and will be sent to any reader for ten cents to cover the cost of printing and mailing.

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INTERESTING EXPERI-MENTS WITH SOLUTIONS

(Continues from page 30)

solution at the bottom of the test tube or beaker. This strong solution then gradually mixes with the water above it until the entire solution is of uniform strength. In the case of blue copper sulphate, this gradual mixing is plantly visible because of the color

Not all substances dissolve in the same proportions in the same quantity of water Given two different substances, it may be possible to dissolve two teaspoonfuls of one in a glass of water while only one teaspoonful of the other will dissolve in the same quantity of water. The first solution, of course, will be denser and beavier than the second

These two properties—diffusion and difference in density-form the basis of an interesting and mystifying experiment that to the casual observer will seem a difficult feat. It consists of carefully placing liquids of different colors, one on top the other, without any visible mixing of the layers

THE experiment, which has been named "Jacob's tube," is performed in a long test tube. In order to place the various layers carefully, the amateur chemist should improvise a long dropper by fitting a length of glass tube with the rubber bulb of a fountain pen filler or medicine dropper

First place a drop of mercury in the bettom of the test tube. If mercury is not on hand, a strong salt solution can be used instead or both can be used if desired. A strong copper sulphate solution is then carefully floated on top of the mercury or salt polyting.

On top of the copper sulphate, float a solution of iron sulphate and on top of this a purple solution of polaseium permanganate vest, bands of clear lead acetate and yellow potassium chromate solutions and a layer of clear water can be floated one on top of the other above the potassium permanganate

To add to the effect, layers of castor oil and light machine oil can be added on top of the water. These do not have to be placed carefully but can be poured directly from their bottles. Red gasoline can be ailded next

If a small amount of colored alcohol, either rubbing or otherwise denatured, is then poured in on top of the gusoline it will not float, but will flow down the sides of the lest tube without mixing and come to rest between the marking oil and the gasoline.

HE result in a tube of various colors ar-I ranged in distinct layers. Of course, the chemical solutions at the bottom of the tube in tune will diffuse into the adjacent layers. but the upper bands, composed of liquids of different densities, will not mix

According to the stock of chemicals be has on hand, the bome chemist can vary his Jacob's tube to meet the supplies in his laboratory. Ordinary household materials such as ofive oil can be added if desired.

USE CHICKEN FEATHERS TO MAKE PLANE QUIET

Americanes with feathers may soon be adopted on the large authors. However, the leathers will not be used for support but | for deadening the sound of the engines. Experiments being carried on in a Baltimore Md., laboratory have shown that a layer of feathers between the walls of a plane's cubin does much to make the interior soundproof The quilt, it is said, absorb the sound trammitted from the tiny vanes. One of the largest American aviation companies recently completed successful tests, using ordinary chicken feathers as the soundproofing material in the cubin walls.







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The Popular Science Monthly 381 - 4th Asia

SMALL DOOR LATCHES BENT FROM WIRE



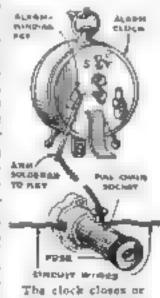
Neat combination door latch and pull made from a short bit of wire and three exaples

SMALL finger latches were needed for the thin wooden doors of some pens housing pet birds. The smallest books available were far too large and clumsy, so the latches were quickly bent from stovepipe wire as shown above. The center or circular portion for the finger was formed around a lead pencil. The lower ends of the wire were bent at right angles to the length of the latch in such a way as to prevent it from supping through the staples. It was set at a sharp downward angle to prevent any possibility of the door's becoming unlatched by accident. The circular part, when moved back, turns up slightly and affords a ready grapfor the thumb and finger in pulling the ager open.-F. B.

CONTROLLING CIRCUIT WITH ALARM CLOCK

MANY devices for closing an electric circuit with an ordinary alarm clock have been described in the past, but the ne illustrated has two advantages: It will open as well as close a circuit, and it requires no special wiring. Cut one side of the circuit to be controlled and insert a plain porcelain socket. Into this screw an extension pull-chain socket, and into

the latter screw an A pull on the chain will open the circuit if it le closed and close it if it is open. The chain is tied to a stick or a wire which is either wedged tightly into the opening in the some narm winding key or soidered to the key in such a way that when the alarm goes off, the rotation of the key will pull the chain. The stick or wire extension gives



opens the tireu f

quick action and also, by striking one of the other projections on the back of the clock, stops the rotation. It should be noted, however, that all alarm clocks do not have rotating keys. In buying a clock that is to be used for this purpose, bear this in mind and try

it to see if the key turns.

This device is used to turn on a linotype electric pot an hour before the operator arrives in the morning. It will also turn a radio set on or off, and may be used for many purposes.-G. L. REDMOND.

NEW! BOICE-CRANE JIG

A great step forward in Jig Saw operation has been achieved M in this new Boice-Crane Jig Saw, Operates to perfection. Has many greatly improved features, also several ENTIRELY NEW POINTS of greatest value. For smooth, speedy orkital tion, accurate construction, long life, and moderate cost, this new Boxe-Crane Jig Saw has no equal.

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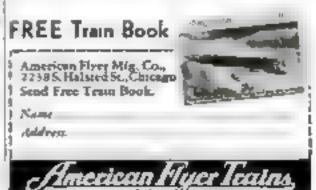
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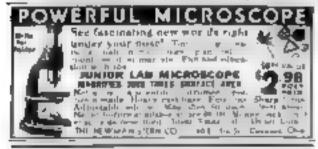
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ONSTRUCTION Casts of materials for bounding a 3 (1 long exhibition model of the U S. S. Trans,

flagship of Battleship Division I aust one of the most powerful battleships, have been as sembled under the supervision of the Popular Science Homocraft Guild. Each kit contains the necessary wood sheet brass, wire, rous, l rass tuling chains bearls, nails, escutcheon juns and other maximals in each everything but the points. (If it is desired to install a power plant in the model, the machinery, of rourse, will have to be obtained separate 5.3

KIT

The price of the kit, sent postpaid to any are rest east of the Missessippi River, is \$6.95 For 50 cents extra, you can also have the five main hull pieces or "lifts" sawed to the rrect shape, if you do not wish to draw the necessary patterns and do the work yourself. This new let is marked if in the list below, which gives all the kits now available Instructions or blueprints accompany each

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bogany. Ready to assemble ... No. 4. Solid mahogany book trough 22%

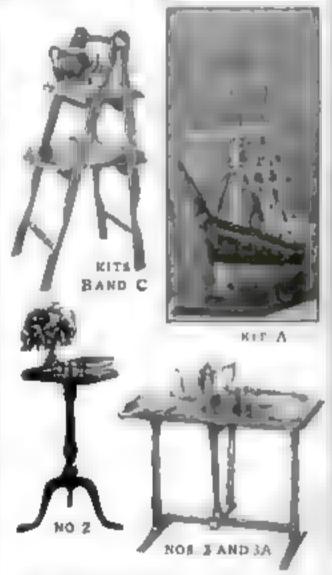
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and 154. The hull is 20 4 in. long 6.90 B. Folding muffin stand in selected sugar pute, 11 in. wide, 19 in. long and 33 in. high when open. All the necessary wood cut to approximate sizes but not machined ... 2 90

together with Bueprints Nos. 151, 152, 153,

C. Some multin stand in birth (can be finished as maple, walout, or mahogany) 2 90 D. Spanish Galleon ship model, 24 in. long All the raw materials (except paints), Blueprints Nos. 46 and 47, and a booklet . . . 0.45





E. Battleship model, U S. S. Texus, 3 P. long. All the raw materials (except points and Blueprinta Nos. 197 to 200...... 6 95

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BIG GAME HUNTING WITH A MICROSCOPE

(Continued from sage 43)

might think they were revolving. Hence the name, wheel bearers. There is a purpose to this motion, by means of it the little creature brings food to its mouth. The polyzoons travel by looping their bodies like caterpillars

We cannot afford to mas the diatomstruy hits of vegetation usually found in the greenish scum in the bottoms of pools. So many forms do diatoms take that men have spent their lives peering at them through microscopes and trying to classify them.

"HE diatom is circular and in really a one relied plant enclosed in a fanty, bard shell. It is constructed on the principle of the pill bax, a slimy secretion covering the exterior of the cell wall and permitting the plant to slide quietly and secency along. We shall also find fossil forms of this life, the live ones being colored green with mature's most abundant paint, chlorophyll

As we examine the little bit of water brought up out of the pool, we shall see many, many things that have not been mentioned in this article. We must recall that the population of the sub-world is almost as cosmopolitum as it is great. After all this is an excursion, not an expedition. If the curiosity of the serious student is whetted, he is referred to his local library where he will find many books on microscopy and the life of the invisible world

As time goes on, we shall want to extend our operations and sooner or later we shall have to have a sort of butchering table upon which to remove the various justs and visceraof beetles, flies, and spiders.

For this work we shall have to make what is known as a dissection interescope. The first thing that we shall need is a fairly powerful pocket lens. No definite specifications either in magnifying power or physical form will be given out I would advise getting the best you can afford. A small mirror, such as women carry, will also be needed.

The hunder need only follow out the directions contained in the sample drawing on Page 47. There is nothing critical about this much ne save the mounting of the mirror and care should be taken to see that this la at exactly forty-five degrees.

"HE little standard in which the pocket lens is held will vary. The matter of mounting the lens will have to be left to the ingentiaty of the reader. Of course, it should be mounted in perfect focus unless adjustment is provided for

Cigar box wood is used along with tiny brade and a good grade of glue. The slanting members at each end of the machine are hand rests and it will be found well to inglude them.

In shaping the metal standards for mounting the magnifying glass, the builder should take cure not to use too thin a piece of bruss. If too thin, the lens will vibrate and interfere with vision.

The glass for the table top is held in place with tiny brads. Great tare is needed in criving these in place for fear of breaking the top. If the builder wishes, he may use a good form of cement and so avoid the risk incident to the use of brads.

Just one more caution, we must not lorget to measure the focal distance of the maguilying glass before we mount it in position.

NEXT month, you will be taken on another exciting journey into the mysteriour microscopic world which, without a powerful glass, we could never hope to see Don't miss this feature in Portuge Science MONTHLY for February, on sale Jan. 3.

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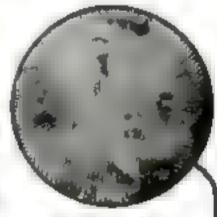
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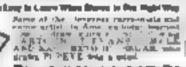
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FAMOUS FIREARMS EXPERT STARTED AS A "COP"

ORTY years ago William A. Jones threw his few and sample belonguigs into a suit-case and left home for New York. For him, as for so many boys raised on a farm, the great metropolis held a glamour and a promise of success that he could never expect to gain in the small country town where he lived.

One day the late Theodore Roosevel then Police Commissioner of New York University down at headquarters, examining a fresh group of applicants for Johs. One man immediately caught his eye and filled it, too-for he was a big. broadshouldered chap with a ruddy glow to his cheeks. Roosevelt could read character at a glance. He liked this man's rigged face,

his steady and honest gaze.

So William A. Jones became a policeman. But he was no ordinary policeman, content merely to patrol his beat day after day, month after month. The records of the New York Police Department testify to the qualities that set him apart from the rest of the "rookie cops" who first denned their uniforms at that same time New York at the time was the Mecca of desperate ctiminals from all over the country. Organized gangs whose members would commit murder for a few pattry dollars infested the city. Jones set out to combat the forces of crime, not merely with the nightstick, which, in his powerful hand was a mighty weapon not mercly with the authority of the Liw recreserved by he buttons and slue I on his broan thest not mere y with his migraticent courage—but with intelligence Citation after citation for conspicuous bravers for extraordinary police work of every sort came to Patrolman Jones unto at last his superior officers deviced to give the talents of this remarkable young cop a larger outlet, and he was made a detective.

HERE was Jones's big opportunity, and he embraced it fully. He was a crack pestol shot and deeply interested in firearms, and be raw in the prientific study of firearms a way in which he could add to his usefulness as a police officer. He was, of course, on duly continuously Yet somehow he made the time to pursue the course of study he had laid out for himself. Promotion came to him, he became a captain of detectives. To his ordinary duties was added the job of conducting the school of marksmanship for New York police, yet he always found time to pursue has studies, which led him into intricate technical paths-ballistics, or the science of projectiles; chemistry and metallurgy as they apply to the manufacture of ammunition and the steel used in gun barrels, photography macroscopy.

William A. Jones is no longer a policeman. He is today one of the comtry's foremost (Continued on page 87)



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Secrets of Success

FAMOUS FIREARMS EXPERT STARTED AS A "COP"

(Continued from page 86)

authorities on brearms, Show him a spent builet and he can tell you everything about the gun or revolver that fired it, except the name of the man who pulsed the trigger! Police departments and prosecutors all over the country are constantly calling on him for consultation or opinion in criminal cases in which the identification of a gun or bullet is of extreme Importance. He has devised ingenious machines to bein him read the secrets of bullets and guns and to demonstrate to courts and juries the secrets he has found.

In his laboratory he is constantly studying, constantly experimenting to broaden his knowledge and perfect his technique His story stands as a splendid example of a man who actually carved his own career through honesty, sincerity, and continuous a.udy,

BUS-BOY TURNS HIMSELF INTO HOTEL MANAGER

HE PICKED a job with a future, started as a bus-boy and now manages \$50,000,000 worth of hotels, That's the story of the amazing career of Ralph Hitz, managing director of the World's tallest hotel the Hatel New Yorker in New York City

The story begins many years ago in Vienna, Austria, where Ralph Hitz was horn. Although he is but a youngster, his father is already planning for him a career as an architect. One day he is taken to cirner at a fine botel in Vienna. In the doorway of the restaurant stands a faultleasty groomed man, thad in spotless evening dress. He is by far the most important looking man Ralph has ever seen, No. architect could ever look like that, he thinks, So Ralph decides that he, too, will be a head wanter

Next surprier he ran away from home and was found working in that same hotel as an eleva or boy. At fifteen he was taken to New York by his father, who was on a husiness trip. Two days after they landed he dampresed-in a strange city, in a country whose language be could not speak! The frantic father was about to call in the police when his son turned up beaming. He had found a job as a hus-boy in a cheap restaurant. He was making \$3.00 a week and he was hapt . Ra , h was coud to protests, threats and pleading The father went back to Vienna without

He held that job for a year and then he decided to see his adopted country. He went to Baltimore and promptly got shanghated as a cook aboard an oyster boat. They were glad to get rid of him His cooking was abominable. Ashore again, he worked his way West, coal mining in West Virginia, peeling potatoes in Chicago, scrubbing floors in St Louis, and washing dishes in Denver, Soon, he was sure, he would (Continued on page 88)

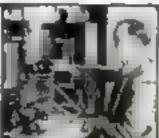
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Secrets of Success

BUS-BOY TURNS HIMSELF INTO HOTEL MANAGER

(Continued from page by)

be a head waiter.

But as he saw more of hotels his desire changed and he set his heart on becoming a botel manager. By this time he knew the mechanics of hotel and restaurant work. Now he began to study the customers; learn why guests preferred this botel or disliked that one,

Up the line he went. In 1917 he came to the Gibson Hotel in Cincumati. He had been there before-twelve years ago -as an assistant head waiter. Now he returned as managing director. The hotel had been losing money steadily. He looked over the books, "Do you think you can put it on its feet?" the owners asked.

"I'll make \$150,000 for you the first year," he answered. When the year was up, auditors went over the books and re-

ported a profit of \$172,000

The New Yorker was built in what is considered a poor botel location, and it was finished just as bad times set in Managing it was considered the loughest hatel job in the country. Ralph Hita, starting cold, made an operating profit of over a million dollars his first year

What does he think of this field as a young man's career? Great, he thinks But it's one business that must be learned from the bottom up, as he did. It's a career that promises success only to those who are willing to work harder and to give more service than is expected of them. That is a short summary of Hata's theory, and no one can deny his success!

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HOMEMADE CHASING DIAL FOR A LATHE

(Continued from page 71)

The attachment hanes on a 5 to-us, studat the upper margin of the flat spot and well forward of the center of its mass. When released by the clampang screw at its center, the device haugs vertically and disengaged. but when tilted forward to the limit of the elongated hole at the clamping screw, the dial assumes a position of greater visibility to the operator and the wheel engages the crew, where it is locked for use

It we be clear that when the indicator is encaged for chasing thread with the screw driving the carriage through the spot put the dial is stationary, for the worm wheeadvancing with the carriage also acceptory with the hour of the wrew and so times not rollate. Whene or he nul is of one l. however. and either serem or carriage mexico, as when revaraing after each successive cut, the wheelthe apain the seems and the dial indicates the access relationship.

Measured on the sectionar indicator 2 in of carrage travel totales the idal one righth reseation or one many for there are each) threads per inch on the serew and 32 teeth on the worm wheel thee turn in the wheel for each 4 in. If one can imag ne the thread to be all and again t the lead serew as in the dispersion on page all it will be seen that only at these points where the two threads are conscient can the nut be engaged. On muttiples of the lead screw, the out can be closed at random, for all even threads (those divisible by two), on any line of the dual; and for odd threads on ans numbered he has had threads (as It time on line 1 and 4, which cor removal a 2 n americals

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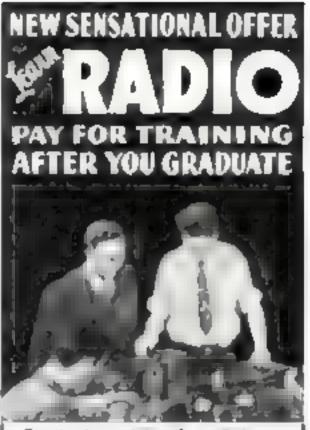
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Sand and emery on linen strips can be obtained at low cost from any dental supply store in all degrees of gril. As these st que are about 5 in. long and up to 14 in write they are ideal for intricate pattern or figsaw work he are Ura

KEEPING PAINTBRUSHES SOFT FOR YEARS

Few paintbrushes used around the house wear out in service. At the end of a job, they usually are cleaned more or less thoroughly, then but away in a can of water, linseed oil, or turpentize and forgotten until again wanted, when the protecting liquid is o ten found to have evaporated, leaving the brushes as hard as a board and useless for transfunc

The proper method, of course, is to dean the brushes perfectly and store them away dry, but few amateur minters will take this trouble. One home tinkerer, borrowing an idea from the kitchen, puts his brushes away individually in fruit jars filled with turpentipe and seals them in by pouring a skim of melted paratin over the turpentine to prevent evaporation. Brushes thus protected are as pliant after a year as the day they were put away - buton STERRET



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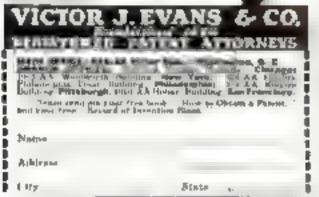
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Delays May Be Costly A FOOTSTOOL THAT WILL NEVER BREAK



The strength of this nest looking fontaton, les in its siers frame. The top is a plain board wetl padded with either corton or curied halr and covered with burlap and tapeatry

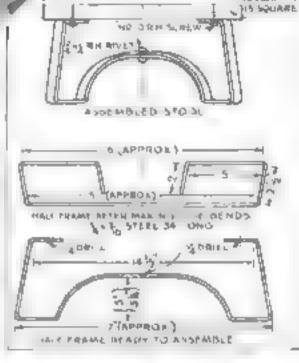
An attembly drawing to given below. together with two detail views that show the steps in bonding each had of the frame, Steel of the succe can be bent cold without difficulty

1544 H 57E FT

EVEN if you have never attempted metal work before, you can easily make this sturdy, good-looking footstoollts frame, as shown in the drawings, is made from two pieces of $\frac{1}{2}$ -in, steel, $\frac{1}{2}$, $\frac{1}{2}$ or 34 m. thick and 34 m. long

The sharp bends are made in the vise with the aid of a heavy hammer Stock of this size can be bent cold without difficuity To make the center bends, catch one end in the vise and hend over by hand, then reverse the ends and repeat. The two halves are identical except that one is 1/4 in, bigher in the center than the other

Having made the two halves of the frame and dralled the three 1/4-in, holes in each, rivet them together and attach them with screws to a 13 in, square board top-The top may be upholatered either before or after it is fastened to the frame, and the upholstery may be as simple or as elaborate as desired. A perfectly satisfactory top may be made by spreading evenly



over the board a thick layer of cutton or curled hair, over which is stretched a piece of burlap tacked on the eages of the buard, and on top of this a piece of lapestry or other upholstery material, tacked under the edges.-LEE M KLINEFRLTER

SALT FORMS QUEER GARDEN IN A DISH

TABLE salt moistened with bottle buing and water sets up a strange sort of growth that eventually forms itself into tiny stalactites and stalagostes of exquisite beauty. If placed in a suitable container and provided with materials on and around which they may grow, the enenistations will develop into an artistic and unusual ofnament.

The photograph illustrates a quant miniature garden in a wide, deep glass fruit plate after two weeks' growth. Small rough stones are first arranged to form a tiny rockery sloping gently from the center of the plate towards the rear. A dry twig is set securely among the rocks at the back, and a small porcelam byore placed in front of the "tree." Twelve tablespoonfuls of ordinary table salt are then poured between and around the stones. Moisten the salt with 3 tablespoonfuls each of bottle blinng and cool water, and set the container aside in any warm room, out of the direct rays of the sun. Each day thereafter add about Z tablespoonfuls of water eased in gently from the end of a teaspoon or dropped with a medicine dropper The aim should be to avoid wetting the growth on too or it will dissolve

The second day a slight growth should be noticeable, Within a week it will have spread well toward the outer edges of the



This curious dah garden was "grown" by adding bluing and water to ordinary table salt

container and up and over the surfaces of the stones, onto the prnaments. The porcelain figure can be kept free of growth by letting the daily application of water trickle down over the form

Instead of a garden, a "pillar of salt" may be preferred. In a deep plate or a shallow glass bowl, stand a china doll, kewpie, or mermaid 5 or 6 in. high. Add the salt, bluing, and water as before

Various tints and tones may be produced by adding 3 or 4 drops of vegetable coloring, colored inks, or water colors to the moistened salt.—M INEZ HOLDEN

HOW TO LOCATE YOUR CAR'S MOTOR KNOCKS

(Continued from page 48)

Benson, intent on learning all he could.

'The best way is to take the car out on the road and drive it arong about filteen to less an hour; ordinary motor noises don't speak up so loudly at that speed. I generally include a few hills in the ride too.

"If I hear a light knock that gets louder when the car climbs a hill, I know that it can be either carbon, loose piston rings, or a loose piston. If the knock has a muffled sound, I mark it up against a worn connecting rod, A pounding engine sometimes means a worn crank shall bearing. In your case it meant that something was loose outside the motor."

"But that a all guesswork," Benson objected "Isn't there some way you can tell for sure just what the trouble in?"

"An auto mechanic" uniled Gus, "is like a detective. He doesn't make any accusations until he's pretty sure. A little brain work in the beginning will save a lot of expensive tool work later on. You've got to go about things systematically and find the trouble by channeling one possibility after the other

"AFTER a good mechanic gets some bunch by using his ears, he can generally run down the actual trouble by making commonsense tests. For instance," Gus led the way to a car purked by the repair beach at the back of the garage. "I took this car out for a test run yesterday and from the noises it made I decided a connecting rod was loose

Now I'm going to test the bearings by running the motor at idling speed and shortcircuiting the spark plugs one at a time." He picked up a rubber-bandled screw

driver and shorted the cylinders in turns. "Noth ng's happened so far," he saw, placing the shank of the tool on the third plug, "but listen to this one."

When the engine was running with all cylinders, a definite metallic knock could be heard, but when Gus cut out one cylinder by shorting the spark plug, the none got fainter and changed to a double knock instead

"That's the cylinder," announced Gus.
"Now I won't have to bother about the rest
You can always locate brazing or piston
trouble by cutting out the explosions on the
cylinders one at a time. A difference in the
sound of the knock will generally tell you
that the short-circuited evilindes is the one
causing the trouble. Of course, two or more
cylinders may be at fault, but you can
generally sort them out by repeating the
test several times."

"WHAT do mechanics mean when they speak of 'piston slap," Berson asked when Gus had closed the bood on the car "That's a knock caused by a worn juston

hitting against the side of the cylinder at the beginning of each power stroke," Gus explained. "You can generally spot the right cylinder by short-circuiting. If the knock stops when a particular cylinder is cut out. that cylinder contains the worn puton.

"Piston slap is a funny thing, though. A cold motor will eften have a piston slap that'll disappear when the motor heats up and the parts expand. If it's a real case of piston slap, all you can do is pull down the motor and fit oversize pistons and see that the connecting rods are properly assized."

When Benson had dropped Gus off in Iront of his house, the old mechanic looked over his shoulder and smiled. "I wouldn't worry too much about all the squeaks nod rattles you hear when you're driving a car he said. "A motor's bound to make some noise when it gets old. But it's only the queer thumps and knocks that mean real trouble."

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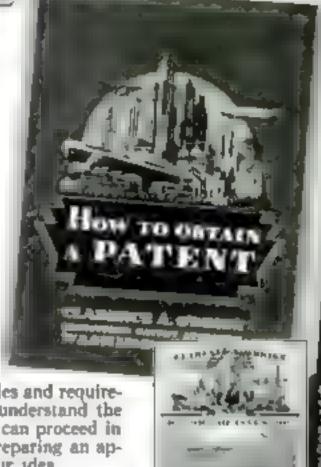
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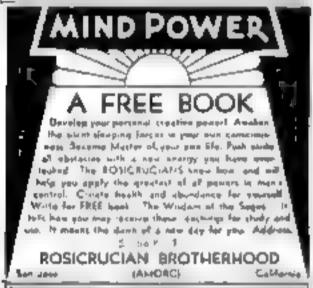






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Make it a Happy Christmas with Popular Science Monthly lipsciel rates this year for conders. See maids of back cover.

PICKED MEN TRAINED TO LEAD SEX POLICE

(Considered from page 30)

dope smurgler is also active. Armed with smoke screens, machine guns, super-powered bonts, and even poison gas, these outlaws are playing a flerce but losing game with the law,

Against these smugglers, the little sailing cutters of the old days have given way to a fleet of several hundred swift picket houts, sturdy steel cutters with turbo-electric drive, sixteen powerful destroyers, Seven brandnew, 165 loot Diesel-powered patrol boats were recently added to this service in the vicinity of New York. An ever-tightening corden is being drawn around our 10,000

makes of coast

Capture of the sum-runner is only one of many duties of the Coast Guard. More than 300 weecks, derelicts, and other dangers to navigation are destroyed each year by ramming, gunnite, or explosives. Laws relating to navigation, quarantine, and neutraitty must be enforced. Medical aid is rendered to vessels engaged in deep-sea fishing Regattas and marine parades are patreffed. Protection is given to seal herds, game, and samon friberies in Alaska. Medical attention, police protection, provisions, and segal services are carried to isolated villagers of the far north.

SINCE the fateful might in April, 1912, when the Titanic rammed an icrberg off the Grand Banks and sank with the loss of 1,500 lives, two cutters have been detailed each spring to patrol the danger region, noting the size pesition, and arit of necessary, the same near the shipping lanes, and oreach a ring the phormatical to provide a scholar 1500 for 2,000 ships, \$10,000,000.000 in proje to good 1,000 000 eves pass through the cone cash season. Due to its watchfulness, not a single ship has been lost by collision with an feeberg since the potent has been in operation.

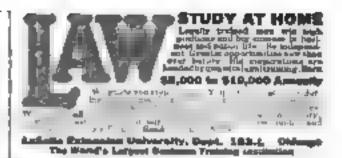
Most important of all the duss of the Coast Gard he sever, and the one was at the expense of all the others when occasion demands, is the rescue of lives and ships. To this end every office must be a her as well as expert seaman. From the cember to March, the most hazardous in othic of the year ou teps of the service good figures. pring the onesh the canarr areas, night for the call it a to where she is More than 250 active land state to, with launches and surf hosts ready to push into the waves, keep watch from the shore

During the fiscal year enting in 1911, the officers, rutter crews, and surmen assisted yeares and care es worth 54 050 465 and saved 50. a new During the ast eighteen years, the value of property saved is more than \$800,000,000 and more than \$0,000 persons were rescued

O's TWO recent trips to New London I. talked with the members of the racult and saw the cardets hand at work. Of Colonial riesign, lared with brick and lime-tone the bu alongs have been adapted to the configuration of the land. In the front row to me away from the river are the classroom and administration buildings and the cadet barracks. Behand these, lower on the slope, are the mach nerv building and the emisted men i quarters. The comi not armors and gymnasium, and the athleric field over jok the river and what:

Captain Randolph Ridgely, Jr., is the first superintendent of the new Academy, coming to the position from the command of the New York Division of the Coast Guard. Captain Ridgely served in the World War, in the submarine 20ne

Captain Q. B. Newman, for many years Engineer-in-Chief (Continued on page 93)



Managers Inventors

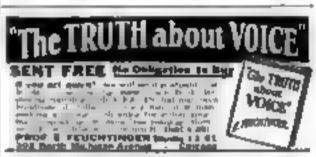
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PICKED MEN TRAINED TO LEAD SEA POLICE

(Continued from page 92)

of the service, is bead of the engineering department. It was Captain Newman who introduced the turbo-electric ship to the Coast Guard and made the equipment lighter and more efficient by substituting a synchronous motor for the customary induction motor It was be, also, who devised a system by means of which the load generally maintained by a ship's auxiliary generators could be transferred to the main driving generators when the vessel was under full way, thus deriving the greater economy of a custral power plant,

The regular classrooms of the Arademy differ little from those of the average college, but many of the rooms in the engineering building are unique. There a cadet runs lathes and maling machines, Diesel engines and turblass, electric motors and dynamometers. In a room fitted to duplicate exactly the boiler room of a regulation cutter, he learns the technique of firing and boiler regulation. On a reinforced stage in the engineering auditorium, heavy machinery may be housted out and explained and demonstrated before a

IT IS the course, however, that distinguishes the Court Guard Academy from both the ordinary nautical school and the college or university of the outside. Beginning and ending with seamanship and marine engineering, it nonetheless covers practically all the cultural ground of the average college and all the discipline, arms practice, and tactics of a military Institution

large study group.

From the end of September until the beginning of June, the cadet spends his days studying the elements of scamanship, engines, navigation, this construction, thermodynamien, mathematics, ordnance, electricity, English, French, navigational law. From the beginning of June until the end of August, he gets a chance to put the knowledge guared

into hard practice on the sea On the annual practice cruise, of which there are three, he learns to swab decks, fire the engines, bandle guns, navigate, and finally to command the cutter on which he said. Every duty aboard the ships of the practice squadron is performed by cadets. Gun drills are held almost daily. Bosts are lowered for rowing practice on rough seas. Before a man is graduated from the Academy, he is expected to enery out all the responsibilities of navigating officer and of officer of the deck.

THE \$780 a year pay of the cadet of the Coast Guard is the same as that of the midshipman at Annapolis, and is enough to provide all uniforms and austenance, and allow a little spending money. Upon graduation, he is commissioned by the President of the United States as an ensign of the U. S. Coast Gaard-a rank equal in pay and status to that of the sim or rank in the Navy He then receives \$1,500 as his base pay, with several hundred do lars more for allowances.

FIREPROOF TREES MAY SAVE STATE FORESTS

Firmy thousand fireproof trees are being raised in South Carolina to help theck forest fires. The State Forestry Department is making an experiment with red alders, said to be practically impervious to fire. A pound of seed was recently planted at the Forest Nursery at Camden, S. C., and the \$0.000 shoots resulting will be distributed for planting in various parts of the state. The red alder matures in four or five years. Planted in fire walls, they are expected to check forest fires,



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HOW MODERN SURGEONS CONQUER FATAL GERMS

(Continued from page 23)

Sometimes, such emergencies come like dashes of lightning

In Birmingham, Ala., a few months ago, Dr T H Williams was in the midst of a delicate abdominal operation when he chitched his left side, gasped, "Doctor, take care of my patient!," and dropped dead of a heart attack. In spite of his shaken nerves, his assistant, Dr R. M. Coston, finished the operation successfully

Again in kansas City Mo, recently a surge n was finishing a night operation for appendicitis when he himself was struken with an acute attack. He collapsed beside the operating table and his assistant had to finish the work and then perform an emergency operation to save the life of his colleague.

Most dramatic of all was an occurrence, not long ago, in Berlin, Germany. The famous specialist, Dr. H. Sauerbruch, was operating on a twenty-two-year-old girl who had developed heart trouble after an attack of induces.

NTHE right side of her chest, the X-ray showed a large swelling. Shortly before, the surgeon had found a similar swelling in a man's chest. It proved to be a blood blister which he had punctured and successfully eliminated. Planning a similar operation on the young woman, he made his incision and cautiously jabbed his needle into the swelling Nothing happened. A second time he jabbed, this time with greater force. Instantly, a thick bloodstream poured out, capidly widening the opening. Instead of a blister, the swelling was a blood-pouch of the heart itself!

Frantically, Sauerbruch sought to stop the rush of blood. Plugging the opening with his fager, he could feel the Riestream within the right ventrule virtually boil and bubble. In the wink of an eye, the operation had become a two-man job, impossible to complete without the aid of his assistant. While he closed the hole as best he could, the assistant placed the statches. Sauerbruch gradually removing his finger as the opening drew together until it was completely closed.

A curious climax to the case is the fact that the patient not only recovered but is in vastly better health due to the elimination the blood pouch. Had the surgeon known what the apparent blister really was, he would never have dared operate. His mutake in chagnosts cured the girl of heart trouble!

When an operation is over, the fight against infection continues as actively as ever. Sterile bandages keep seems from reaching the wound and, when put is present, drainage tabes carry it away. Until the Battle of Turin, in the Sixteenth Century, boding oil used to be poured into wounds to hasten heaving. At this hattle, the oil ran out and surreons discovered to their amazement that wounds which were not treated in this way healed quicker than those that were. Lister, in one of his later experiments, used to place bunches of horseharts. Irested with carbolic acres in wounds, removing the bairs a few at a time as the opening closed in healing.

O'E of the most important medical discoveries in recent years is the use of surnical magnets in curing chronic infections. During the World War, two soldiers who had been injured by shellfire lay in a thicket for seven days before they were discovered and brought to the base hospital. When Dr William S. Baer, famous Johns Hopking surgeon, examined their wounds, he found a remarkable thing. The larvie of blow-fires in them had kept the wounds clean, consuming dead tissue, preventing infection and setting up a healing action.

After the war, Dr. Baer carried on a series of experiments with carefully-bred sterilized maggots. With them, he achieved remarkable success in treating almost incurable hone infections, compound fractures of the thigh, and tuberculosis of the hip. Out of 200 cases treated at the time of his death in 1931, he had achieved ninety-five percent cures among children and righty five percent among adults. Since then, his method of treatment has been widely adopted

Not only is it important to give careful attention to the outside of a wound to prevent infection, but also the circulation of the blood to it, purifying it from the inside must be unimpaired or gangrene is likely to set in. At the famous Mayo Clinic, at Rochester, Minn, not long ago, a remarkable bit of surgery saved a patient from this dread form of infection.

A HOTEL guest awoke in the middle of the night with a stabbing pain just above his left ankle. It felt as though the bone were dry and about to break. His foot was numb and black and brown blotches were beginning to appear on his leg. Thoroughly trightened, he called the hotel physicians, who diagnosed the mysterious trouble as a blood-clot in the main actery of the left leg. Unless the clot could be removed, allowing the blood to flow freely to the leg again, gaugette would be necessary

The suffering man was rushed to the Mayo Chase. Here, one of the famous surgeons of the staff made a tray slit, only an inch long, at the point where the obstruction was located. Clamping the artery to prevent bleeding, he cautiously pushed his scalpel blade through the wall and with deft fingers removed two large clots. When the artery had been accurely sewed up with surgical silk, he removed the clamp, Once again, blood flowed through the limb, Immediately its condition improved and to a short time the patient was out of been

For permanent stitches in atteries and intestions, sterilized silk is used. In places where tustes will grow therefore raight which dissolves and is absorbed by the body, is employed. These catgut threads or satural are timed to dissolve in eight task for dark twenty days, and forty days, the surer in choosing the type that will hold the tissues together just long enough for them to know the surers withstanding the action of the chemicals of the body longest are ones which have been tagged by the process that produces chrome leather

N SURGICAL sewing at h important to injure as little of the tusue as possible listead of being threaded through an eye the ratgut h attached directly to the needle one end slipping into its bollow rear and being trimped to place. Thus the hole made up the tissues in sewing is the diameter of the thread instead of twice that, as would be the case if an eye needles attached, in hermetically-sealed glass tubes, some straight and some shaped like little cases. These tubes are broken and the sutures extracted as they are needed during the operation. When the work is done, the predicts are clipped off and thrown as as as

All surgical catgut comes from the intestines of sheep with the exception of a special, super-strong variety used in tying bones together. This is obtained from the tail tendons of kangaroos. In small skin wounds, where there is little tension, horsehaur is sometimes employed as surgical thread. Clim are now widely used in (Continued on page 95)

Kame

A Struck

HOW MODERN SURGEONS CONOUER FATAL GERMS

(Continued from page 94)

place of sutures to holding together many kinds of external wounds.

One of the queerest cases I remember in which a makeshift suture saved a life, occurred, a few years ago, five hundred miles at sea. A young doctor had shipped at the lust minute as surgeon on a dilapsdated, cutrate steamer, carrying 900 passengers. The ship was past Sandy Hook, heading for England, when he examined his equipment. He found there was no operating room, no sterilizing equipment, and only a few out-ofdate surgical instruments on board. Then, five days out, one of the passengers collapsed

with an acute attack of appendicitis! The captain informed the surgeon he could operate wherever he pleased. He chose the smoking room and had it cleared. Draping sheets around two card tables in one corner he formed a booth which he disinfected with

formalin lamps.

AN OLD Russian apothecary on board ad-ministered the anesthetic. Just as the patient was going under, the doctor discovered all the sutures were rotten and would break at the slightest touch! Was there a violin on board? The chief officer dashed upstairs and returned with the skipper's fieldle. Tearing off the E-string and sterilizing it, the surgeon used it for catgut to sew up the wound at the end of a ninety-minute operation which resulted, miraculously enough, in the patient's complete recovery,

HUNDRED years ago, a patient needed superhuman courage to undergo an opreation for he was conscious while the isorgeon worked and had to bear the pain as best he could. That is no longer true. The discovery and use of anesthetics is a thrilling chapter in the story of modern surgery. Next month Dr. Damrau will tell what an anesthetic is, how it is administered, and the effect it has on the patient. Also he will describe amosing operations performed with its help. See POBULAR SCIENCE MONTHLY for February.

HOW YOU CAN TALK OVER RADIO TRANSMITTER

(Continued from page 35)

cruphone is connected by means of a separate circuit, which consists of a microphone, a battery, and a transformer, Any variations in the resistance of the mirceophone will then cause more or less current to flow in the primary of the transformer,

With grid-bias modulation, the microphone circuit is so connected that variations in the microphone resistance, caused by sound waves, set up an audio voltage which is alternately added to and subtracted from the normal grid-bias voltage. This audio-frequency varlation of the grid bias then causes corresponding changes in the antenna current.

In the plate voltage modulation system, the microphone is so connected that the plate voltage is varied in a similar manner. These changes in plate voltage then cause corresponding changes in the antenna current.

In both methods, the additional micro-phone circuit is operated to alter a control voltage and upset the normal operation of the vacuum tube.

Unfortunately the power that the microphone circuit can add to the plate circuit is small. This accessitates the use of a suitable amplifier for the audio-frequency power-

NEXT month, Mr. Carr will continue his discussion of modulating systems and give valuable pointers for adapting the teamsmitter you have for radio belephone operation.



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Read These Letters!

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MIDWEST RADIO CORP

Auto Stealing Now \$50,000,000 Racket

duplicate keys for starting the our he picks out.

There are three ways in which thieves handle a "hot car" after they steal it. They may hide it until the storm blows over; they may "scramble" it and then try to sell it; or they may attempt to dispose of it

immediately.

A year or so ago, a brand-new sedan which had been driven only five miles was stolen at Portland, Oregon, and appeared again the following spring. It had been hidden under hay in a barn during the winter. Capt. Dillon, told me of another case in which a thief in upstate New York was so frightened by his near capture that he left the machine he had stolen under bay in a barn for nine months. When he brought it out, rats had caten away the whole top. But it had been on the road only a week when police arrested him! Usually gange try to dispose of their stolen machines in rural communities where they are less likely to come to the attention of the city police.

In "acrambling cars," a number of machines of the same make and model are stolen at the same time. In some underworld garage, they are then torn apart. Wheels are switched, transmissions shifted, bodies changed, and engines transferred from one car to another. In one case, twelve machines of the same design were taken apart and scrambled by a New York gang to hinder identification. A special garage, midway between New York City and Philadelphia, Pa., used to be used for altering and scram-

bling stolen cars,

SOME gangland mechanics are past-masters of camouflage. There is one instance actually on record in which a country storekeeper bought his own machine three times? A gang stole it, camouflaged it and sold it back to him twice. He finally grew suspicious when his pet dog appeared to recognize the car, Jumping up into the seat as soon as it

was driven into the yard.

If the trained experts of the automobile squads can examine a machine thoroughly, they can identify a stolen car in spite of the most cusning camouflage. They have at their disposal secret means of identification unknown to the ordinary officer. By means of special asbestos sheets and blowtorches, they can bring back altered numbers on motors. In Los Angeles, Calif., a system of "fuger-printing" auto tires to help track down thieves has been developed. Elaborate cross-filing systems and frequent check-ups of the motor numbers on registration lists provide valuable clues. In one western state, a few years ago, twenty-five machines were found registered with the same motor number !

Recently, thanks to the radio police cars which receive descriptions of stolen machines while cruising about the streets. the recoveries in large cities have mounted to approximately eighty percent of all

the automobiles stolen.

Probably the most cunning stratagem of all was worked out by a lone wolf auto thief in New York City. It enabled him to dispose of twenty-one stolen machines be-

fore be was caught,

With his wife and baby, he would drive up and down the main streets of the city until be found a parked machine exactly like his own with an empty space either ahead or in back of it. Then; he would park his own machine in this empty space and all three would go into a store for a minute or two, come out and "by mistake" enter the wrong machine and drive away. A complete set of keys for that particular make and model permitted

him to open doors and unlock switches and transmissions. If the owner saw him, he would apologize for his error and get into his own machine, of identical appearance.

Another daring ruse is often resorted to by games to make a quick sale. After a machine of a particular make has been spotted, an advertisement is inserted in a newspaper offering for sale the auto which

is yet to be stolen!

Those interested are requested to call a certain number. When they do, they are told the car will be parked at the appointed bour directly across the street from "our downtown showroom," giving the address of a leading dealer in that make of machine. The "hot car" is parked at the spot a few minutes before the customer arrives.

The customer is told a plausible story as to why the company across the street is able to sell the machine at a ridiculously low

Police Get a Loud Voice



VIOLATORS of traffic regulations at Stratford, Conn., are spoken to by the police in clarion tones that can be heard for n mile. A microphone and a londspeaker on top of the police booth are used in directing the drivers on the four-lane express highway.

price. After a few minutes, the "salesman" says; "I like your looks. Wait a minute." He goes across the street into the showroom where the customer sees him talking to the men inside. In reality, he is asking if he can borrow a pencil or wash his hands. But, when he returns, he announces that "his partners" have agreed to an extra-special price for a quick sale. The buyer pays cash and receives the papers which have been prepared beforehand. His receipt is signed with a flourish "vice president - Company." He never realizes he has not dealt with the

authorized dealer until a motorcycle con tells him to pull over to the curb and he learns he in driving a stolen car!

URING the last two years, business conditions have given rise to another problem for the men of the automobile squad-Owners are hiring thieves to steal their cars!

The thief gets \$100 to destroy or alter the machine so it will never be recovered, while the owner, at the end of sixty days, collects his insurance in ready cash. In New York City, last year, a manufacturer and a storekeeper were caught dealing with such thieves. In both cases, the exposure rained their credit and forced them out of business.

One authority with whom I talked, gave me the amazing estimate that twenty five percent of all the autos reported stolen loday are pover stalen at all. The owners bide them, run them into swamps, or tear them to pieces

and report they have been stolen to collect the insurance. Again, each year, hundreds of people who receive parking tickets try to escape paying the times by telephoning headquarters that their cars have been stolen and then maintaining the thief had left the machines where they were given the ticketal

During one of my talks with an expert who is in charge of 200 trained detectives covering a dozen eastern states, I asked what simple precautions an owner can take to keep his machine from being stolen and how the purchaser of a secondhand automobile can spot and avoid a "hot car" when it is offered for sale. In reply, he gave me the following do a and don'ts, which I pass on to you;

To keep your car from being staten: (1) Don't park it in the same place every day. This gives the thief a chance to study your habits or copy lack num-

bers and get keys to fit. (2) Never leave your car for any length of time unlocked. Seventy percent of all cars that are stolen were left unlocked by their owners. Automobiles with doors and switches or transmissions.

locked are rarely taken,

(3) He sure the windows are all closed tightly when you lock your machine. Rear windows, particularly, are often left down an inch or so without attracting the attention of the owner and provide a chance for the thief to get inside.

(4) Never leave your car with the cogine running even in your own driveway or when you intend to be in a store no longer than a minute. It takes but a few seconds for a third to step on the gas and get away while your back is torned.

(\$) And, he especially on guard after oark when purking near theaters or other places of entertainment winter your will

be gone for several hours.

To AVOID purchasing a stolen car: (1) Watch out when the seller wants cash instead of a check.

(2) Take time to investigate when the price seems too low or when the seller appears willing to do too seach for you.

(5) Don't close the deal in a horry. Wait a week before giving your final decoton. Auto thieves can't wait, they have to sell in

(4) Be on your guard when the seller gives as his reason for dispusing of the car the fact that he has "gone broke in Wall Street" or has lost money on the races. These are stock excuses among auto thieves so don't. take them at their face value.

(5) And, finally, If you are at all suspicious, and live in a large city, call up headquarters and have the engine number compared to

those on the list of stolen cars.

"How Do I KNOW IT'S Christmas?"

(By A Man Who's Been Through It Many Times)

VEN without holly and tinsel, trees and ornaments. I'd know it. One day—every year without fail—I walk into a room where there are a lot of packages marked for me. After they are opened, I find myself richer to the tune of one dozen neckties and two dozen pairs of socks. 'This must be Christmas', I say—and so it is.

"Now, I know that every Christmas present comes from the heart, but I'm practical and I wish they'd put a little more 'head' in with the heart. Neckties come in such astounding colors that I'd rather pick my own. And you can't do much with Christmas socks that are a size too large or a bit too small.

"Just let me put in a word for myself—and for a couple of million other men like me. We like Christmas presents, and we like to give them. But when we're on the receiving end of the exchange, it does our hearts good to get a really sensible gift—of practical and permanent value. Something that gives us enjoyment, something that reminds us of the giver—makes us think of him gratefully—six months—twelve months after Christmas has come and gone."

That's a frank, man's point of view. Isn't it yours? Aren't there men you know who you're dead certain feel that way? Wouldn't such a man say you used both heart and head when you sent him Popular Science Monthly for a year, as a Christmas Gift?

You know—without our telling you—what a delight Popular Science Monthly, with its fascinating news and amazing photographs of scientific progress all over the world—can be to the man who wants and values a practical gift. When you make this gift—be he father, son, brother or friend—a year's subscription to this graphic magazine, every new issue brings him another reminder of Christmas—and another grateful thought for the friend who made so wise a selection.

While we're on the subject of gifts, we'd like to give a little Christmas present ourselves. The regular subscription price of Popular Science Monthly is \$1.50 a year-but, to every reader who wishes to send the magazine as a gift, we'll give our own Christmas present of twenty-five cents, so that, for each friend to whom you send Popular Science Monthly on this special occasion, you need send only \$1.25 instead of \$1.50. Here, however, is a gift you cannot measure by cost, because it is so very inexpensive—and yet its worth in terms of interest and genuine pleasure for the gift receiver is invaluable. And, to carry out the spirit of the season still further, we shall mail to every friend to whom you send Popular Science Monthly as a Christmas Gift, an appropriate Christmas Card, bearing your own name and your good wishes, and telling him Popular Science is coming as your gift.

If you want to send a gift that means something—and, if you want to avoid the discomforts of last-minute shopping in crowded stores—Popular Science Monthly is certainly the solution to this year's gift problems—for every man on your Christmas list. Use the convenient order blank, sending your remittance now or indicating below that you wish to be billed for the amount after the Christmas Holidays—and mail it back to us today.

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I really don't know if I should smoke . . .

... but my brothers and my sweetheart smoke, and it does give me a lot of pleasure.

Women began to smoke, so they tell me, just about the time they began to vote, but that's hardly a reason for women smoking, I guess I just like to smoke, that's all,

It so happens that I smoke EHESTER-FIELD. They seem to be milder and they have a very pleasing taste.



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